Distr.
LIMITED

UNIDO/IO.593
29 August 1984

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ENGLISH

Regional Network for the Production, Marketing and Control of pesticides in Asia and the Far East
DP/RAS/82/006

Regional Workshop on the Formulation of Pesticides

New Delhi, India 6-10 February 1984

REPORT*

---

*Prepared for the Member Countries of the Network and other participating countries of the Region. This document has been reproduced without formal editing.

V.84-89564

CONTENTS

		Page
-	Introduction	1
-	Opening of the Workshop	1
-	Presentation of Technical Papers	4
	a) Development of Formulation with Special Reference to their uses and applications	4
	b) Selection of Formulation Adjuvants	4
	c) Pesticide Formulation Design	5
	d) Pesticide Analysis Methods	5
	e) Recent Development in Application Technology	5
	f) Key Issues concerning the establishment of plants for the formulation of agrochemicals	5
	g) Controlled Release Granules	6
	h) Machinery and its Development for Pesticide Formulation	6
	i) Flowable and Wettable Powder Formulations of Fungicides and Herbicides, Techniques of Preparation, Properties and Applications	6
	j) Surfactants in Pesticide Formulations	7
	k) Bioefficacy Studies on Pesticide Formulations	7
	l) Problem in Residue Analysis of Pesticides	7
	m) Occupational Health Hazard	8
	n) Pesticide Formulation and Engineering Aspects	8
	o) Packaging of Pesticide Formulation	8
-	Conclusions and Recommendations	9
	Appendix I List of participants	14

INTRODUCTION

1. The International Workshop on Pesticide Formulation organized under the auspices of the Regional Network for Production, Marketing and Control of Pesticides in Asia and the Far East was held on February 6-10, 1984 at the India International Centre, New Delhi, India.

2. The Workshop was attended by 10 delegates from 9 participating countries of the Regional Network and the ESCAP Region: Bangladesh, India, Indonesia, Korea, Nepal, Pakistan, Philippines, Sri Lanka and Thailand. The Workshop was also attended by the Regional Network Coordinator and one member each from UNIDO, ESCAP and WHO. The delegates from Afgahnistan was not present. The list of participants is attached as Appendix I of the report.

3. The Workshop was intended to:

   a) Identify specific areas in pesticide formulation technology where developmental efforts are required;

   b) Encourage the utilization by local formulation plants of raw materials available in the region like carriers, solvents and inerts;

   c) Determine the scope of research and development in formulation technology;

   d) Plan specific activities in the field of pesticide formulation, where regional cooperation can be strengthened.

   As a result of the deliberation, a workplan will be prepared for future activities of the Sub-network on Formulation operating under the Regional Network Project.

OPENING OF THE WORKSHOP

4. The Workshop was inaugurated by Mr. Rama Chandra Rath, Honorable Minister of State for Chemicals and Fertilizers, Government of India.

   Quoting the Prime Minister of India, The Minister said that success is to be achieved not through curtailing the use of pesticides but by organizing their proper use through development of safe products. He emphazised the utilization of locally available raw materials and cooperation and inter dependence among the countries of the region. He also acknowledged the role of UNDP and UNIDO in undertaking the first regional cooperation programme to promote development of the pesticide industry and the safe and effective use of pesticides especially in depeloping countries in this part of the world.

5. Mr. M. J. Priestley, the Resident Representative of UNDP, New Delhi, in his introductory address focussed on the assistance provided by UNDP and stressed the importance of pesticides to enchance food production in India and the region.

6. Mr. S. R. Panfil,Senior Inter-Regional Adviser of UNIDO, introduced the objectives and activities of the Regional Network project.

7. Mrs. Cecilia P. Gaston, Regional Network Coordinator, in her welcome address dealt with the purpose of the Workshop.

8. On behalf of the host organization, Dr. Ram S. Hamsagar, Chairman and Managing Director, Hindustan Insecticides Ltd. and National Coordinator of the Network Project, elaborated on the local pesticide formulations and their relevance to the developing economies. He laid special emphasis on the R&D efforts by the developing countries themselves to meet the technology needs of tomorrow's pesticides.

TECHNICAL SESSIONS

9. The workshop consisted of nine Technical Sessions covering the different aspects of pesticide formulation technology. The details of the programme are as per Appendix II.

TECHNICAL SESSIONS

10. Country papers highlighting the current status of the pesticide formulation industry were presented by the respective delegates.

BANGLADESH

11. In 1979 the Government of Bangladesh handed over the pesticide industry to the private sector except the National Pesticide Testing Laboratory, which was set up in 1965. The only technical product being manufactured in the country is DDT.

INDIA

12. The paper presented the latest data on requirements, production and consumption of pesticide formulations. It also gave details of R&D activities relating to development and technology for pesticide formulations currently being undertaken in the country including the activities of the Pesticide Development Programme, India, which is being implemented with assistance from UNDP/UNIDO. The paper also listed out possible areas for future development of formulation industry in India

and offered areas where India can contribute and cooperate with other countries of the region in the field of formulation technology.

INDONESIA

13. The paper highlighted on the increased use of pesticides in recent years mainly because of subsidized supplies through the BIMAS/IMMAS programmes of the Government. The present pesticide formulation production capacity is sufficient to meet the requirements till 1989. Even though many of the raw materials required for formulations are available locally, these have not been fully exploited. The immediate objective for R&D is utilization of locally available raw materials.

KOREA

14. With the advancement of chemistry and technology, pesticide industry in Korea has made significant improvements, especially in the fields of technical synthesis, formulations and quality control.

NEPAL

15. Pesticide industry in the country is comparatively young though the commencement of the use of pesticides goes two decades back. The first pesticide company was started in 1972 in the private sector followed by the pesticide company in the Public Sector in 1977. A Pesticide Board has also been set up governing various aspects of the trade.

PAKISTAN

16. The pesticide industry of the country which is mostly formulation-based has been in the private sector since 1980.

PHILIPPINES

17. The pesticide industry of the country is entirely in the hands of private sector. It is built around 20 companies under the trade organization, Agricultural Pesticides Institute of the Philippines (APIP), which is responsible for 95% of the industry.

SRI LANKA

18. Technical material as well as solvents/adjuvants are not produced locally while certain solid carriers are available locally and are being used in local formulations. Present formulation capacities are adequate to meet the local consumptions of pesticides. The pesticide industry is rapidly growing in Sri Lanka to ensure greater agricultural productivity.

THAILAND

19. The pesticide industry in the country is still in its infancy and hence research in pesticide production and formulation must be encouraged. Obstacles like lack of technology, testing facilities for local raw materials and selection of suitable pesticides for manufacture and marketing of products can be overcome through regional cooperation especially with the technical and financial assistance from UNIDO or UNDP.

PRESENTATION OF TECHNICAL PAPERS

Development of Formulation with Special Reference to Their Uses and Application.

20. Starting with the development of indigenous technology in making formulation auxiliaries, especially synergists for insecticides, the technology of making a number of conventional as well as newer pesticide formulations has been developed. Some of the significant achievements include the development of emulsifiable concentrates of carbaryl, photodegradable formulations of DDT, improved DDT emulsifiable concentrates and certain conventional formulations based on the biologically active neem crudes. Of the newer formulation, a significant breakthrough in developing technology for the manufacture of dispersible granules has been achieved. Basic information such as the role of solid carriers in transforming malathion into iso-malathion has also been generated.

Selection of Formulation Adjuvants

21. The proper choice of formulation ingredients is one of the most important and most puzzling problems of pesticide formulation technology. Due to the advances made in recent years in this field, it has become possible to decide on various formulation adjuvants systematically and based on scientific principles. The paper deals with the criteria for selecting different formulation ingredients from a practical point of view. Selection of the following ingredients were discussed:

a) Inert materials required for the preparation of dry formulations
b) Solvents required for liquid formulations
c) Surface active agents

Pesticide Formulation Design

22. Pesticides are effective in minute quantities per unit area. Appropriately designed formulations provide a suitable means of delivering them evenly. The technical material can be formulated in different ways. Possibilities available from the physical properties of the technical material, target pest and application method are some of the determinant factors in designing the formulation type. Proper selection of various inputs and production process are also an integral part of formulation design. Using as example some of the widely used formulations, designing principles were discussed in the context of safe, economic and reliable application of pesticides.

Pesticide Analysis Methods

23. For determination of physico-chemical characteristics of a pesticide, the methods mostly used are gas liquid chromatography (GLC), high pressure liquid chromatography (HPLC), thin layer chromatography (TLC) and spectrophotometry. GCL is the most commonly used method for pesticide analysis as the detectors available have become more selective and sensitive. On the other hand, HPLC, a relatively new technique at present is not widely used because detection systems available are not often sufficiently suitable for pesticide residue analysis. However, it has a useful role to play in the analysis of formulated material. TLC has lost some of its popularity but has great advantage over the other two techniques in being relatively inexpensive and normally does not require sophisticated instrumentation. The principles involved in the use of these techniques, their advantages and limitations in the analysis of pesticides were described and discussed.

Recent Developments in Application Technology

24. The paper deals with the common pest diseases and their remedial measures in various crops, fruit and ornamental trees. Use of low cost ideas on application technology developed indigenously by the author was also discussed in detail.

Key Issues Concerning the Establishment of Plants for the Formulation of Agrochemicals

25. The paper deals with various aspects and problems related to the establishment of formulation plants namely:

1. Economic viability
2. Access to reasonably priced local raw materials and packaging relevant and access to active ingredient

3. Expertise in planning and operation
4. Access to local resources
5. Foreign exchange control and exchange rate problem
6. Access to know-how and service
7. Safety, hygiene and environmental viability
8. Rigid quality control and modes of packaging

26. The economics in locating an agrochemical formulation plant in developing countries was also discussed.

Controlled Release Granules

27. The paper consists of various concepts of encapsulation technology dealing with choice of matrices, solvents and binders. Various concepts relating to encapsulation technology were discussed. The paper also gives a description of micro and macro capsule, hollow fibre monolithic and laminate structure.

Machinery and Its Development for Pesticide Formulation

28. Machinery for processing pesticide formulation needs to be selected after careful study of the toxicant as well as the carrier material. The physical and chemical properties, heat sensitivity, flash point, solvent content, type of solvents, moisture content in carrier material, etc. need to be considered. Further, the optimum size and degree of sophistication desired must be related to output per unit time required, product formulation to be handled and other economic factors. Typical examples were presented for discussion.

Flowable and Wettable Powder Formulations of Fungicides and Herbicides - Techniques of Preparation, Properties and Applications.

29. This paper deals with the need for new formulations, which would be more effective in controlling pests, and at the same time would not cause problems like pesticides drift and residual toxicology. Ways and means for developing effective herbicide formulations were discussed. Different methods for the preparations of Wettable Powders, Flowable and granules were also discussed.

30. Surfactants in Pesticide Formulations:

Surfactants are ampiphilic molecules with a polar hydrophilic head group and hydrophobic tail. They are classified into three major categories depending on the ionic nature of the hydrophilic group- anionic, nonionic and cationic. The ampiphilicity is responsible for the accumulation of surfactant molecules at interaces between two phases. As a primary consequence there is reduction in interfacial energy. A number of secondary properties such as ease of wetting, formation and stabilization of emulsions etc. are important for the application of surfactants.

Among the large variety of surfactant applications, their use in agricultural emulsions including pesticides is an important one. The formation of fine droplets of emulsions is the result of reduction of interfacial tension to extremely low values. Electrostactic repulsions, steric/entropic factors are some of the forces involved in the stabilization of emulsions. The HLB concept is of practical value in the choice of emulsifiers for specific applications. HLB values can be calculated from empirical molecular parameters and can also be experimentally determined.

Apart from the above mentioned molecular aspects techniques for the preparation of emulsions, physiochemical characterization, method for study of stability and other relevant aspects were covered in the talk. Special problems related to pesticide formulations were also dealt with.

31. Bioefficacy Studies on Pesticide Formulations:

Pesticide formulations differ in their bioefficacy to insects and other animals. In general, solutions are more toxic than emulsifiable concentrates which in turn, are more toxic than wettable powder/dispersible powders while the latter are more toxic than dusts. Even the same formulations of a particular pesticides formulated by different formulators differ in their bioefficacy. Such formulations also differ in their residues and shelf life.

32. Problem in Residue Analysis of Pesticides:

The availability of a wide range of pesticides has been responsible for increasedcrop production. Unfortunately, these chemicals can also lead to adverse effects on human health and environment. Once toxicological studies have established the probable degree of hazards of a chemical, residue analysis is required to regulate the usage of the chemicals to the desired level of safety. Accurate residue data are required towards food safety, movement and dissipation of agrochemicals, uptake and effects on wild life, disposal of toxic wastes, occupational safety and pest control efficacy. Residue can be grouped into three main types, namely,

(i) Food and Feed (ii) Environmental (iii) Human tissue. Determination of accurate residue data requires a lot of scientific endeavours and usage of sophisticated equipment.

33. Occupational Health Hazard:

The concepts of toxicity and hazards including statistical studies on pesticide hazards relating to chemical industries were discussed in detail. Recommendations regarding the proper safety in pesticide handling for the formulators and consumers were also discussed.

34. Pesticide Formulation and Engineering aspects:

The technical-grade pesticide is unsuitable for direct application due to its toxic nature. It needs to be formulated to the required concentration of toxic chemical and type for its specific application and use. Important unit operations involved in the manufacture of pesticide formulation, are mixing, particle size reduction, granulation, solid separation material storage conveying, etc. For the successful manufacture of a product of specified quality, the engineering aspects of a chemical plant are as important as the process know-how itself. The principle applies in the case of pesticide formulation plants although only physical processes are involved in its manufacture. Close study and coordination of the various process requirements, state regulations and clientele requirements, are essential considerations from the early stages of process engineering through project execution and actual commissioning of the plant.

Important pesticide formulations were illustrated with brief descriptions. The various equipment units commonly employed to perform the unit operations, product packing, dust control, safety and health were presented. The performance characteristics of the units and criteria for their selection and engineering aspects to be considered were also given. A survey of equipment evailability in India was presented.

35. Packaging of Pesticide Formulation:

Over the past few years, packaging technology has been accepted as a science. The paper gives an account of a number of benefits from the adoption of suitably designed packaging. Also, the requirements for packaging, factors influencing package selection and packaging material, along with the newer trends in packaging of pesticides have been discussed in detail.

CONCLUSIONS AND RECOMMENDATIONS:

36. The Workshop

The Workshop noted with interest the progress of the pesticide formulation industry in the region and the need and possiblity of improving and encouraging the pesticide formulation capabilities; introduce safer pesticide formulations.

Having further noted the availability of the expertise in the region;

Having recognized that the expertise required to satisfy the growing need of the region have not yet reached the desirable level of collective self-reliance;

Having noted that considerable sophistication and knowledge exist in the developed countries especially within their pesticide industry;

Having emphasized that all efforts be made to utilize the knowledge and expertise available in the region with a view to ensure safety, efficiency and economy in the formulation of pesticides;

Recommends that:

The exchange of experience in pesticide formulation among the countries of the region should further be promoted, and in particular, the technological know-how available in the more advanced developing countries should appropriately be adopted whenever possible. Certain special local features of pest problems and novel and effective local solutions developed in the region as brought out in the expert technical papers were of special interest in the significance of local expertise for adoption to the region.

37. While having learned from the presentations that some of the countries in the region have few, if any formulation plants and have to import pesticide formulations and in some cases even carriers in large quantities;

The Workshop identified the needs for and scope of assistance required under these circumstances based on expertise available within the region for setting up of pesticide formulation facilities and development of local carriers for formulations.

38. The countries concerned when seeking assistance regarding the establishment of new formulation capacities should primarily take into consideration the market potential existing in the region and the availability of regional resources such as raw-materials, technology, expertise, consulting services, plant machinery and equipments in the region.

Recommendations

The Workshop

Having noted the existence and exploitation of indigenous raw materials for pesticide formulations;

Having recognized mineral suitability of local production of pesticides;

Recommends that:

Surveys should be carried out in the countries of the region where needed to realistically assess their local requirements, the availability of such suitable raw materials and their quality, and to investigate into the possibilities of utilizing them within the region.

39. Further having noted the need to facilitate mutual trade in chemical products for the manufacture of pesticide formulations, such as intermediates, solvents, surfactants and adjuvants, as well as technical grade active ingredient;

Having recognized the need to provide opportunity for countries which do not possess their own local resources to acquire such raw materials from within the region on preferential terms;

Recommends that Countries of the region take active part in the preparations for the Expert Consultation on Trade and Tariffs which is being convened by REMFAP in Sri Lanka in the second half of this year.

40. The Workshop focussed particular attention on the necessity of developing or strengthening R & D institutions in the region dealing with research on pesticide formulations, quality control and their efficient use in agriculture.

Having noted that certain local techniques if adopted in the region could result in substantial reduction and enhanced safety to applicators;

Having further noted that while there is ready local expertise available on most conventional formulations like dusting Powders, Wettable Powders, Emulsifiable Concentrates, Granules and ULV formulations, the development of newer, safer and more effective and economical formulations for the region needs to be encouraged.

Having recognized the need to encourage and strengthen R & D efforts for development of slow release pesticide formulations, flowables/suspension concentrates, aerosol, micro emulsions etc. to ensure self-reliance of the region in the future;

Having further noted that such would require cooperation with pesticide research laboratories of advanced countries;

Recommends that:

Existing R & D institutions in the region be strengthened by making available to them foreign assistance, inter alia to be provided, through international organizations. Inter-country cooperation in R & D should be facilitated by the respective governments of the region. In this effort, the existing R & D facilities such as those established by the Pesticide Development Programme India (PDPI) be extended to other countries of the region and consider regional work on pesticides formulation development with local raw materials.

41. Having further recognized that local R & D efforts should be directed towards developing technologies for low cost, high quality, pesticide formulations and innovative application techniques to make pesticide economical, safe and simple suiting the local, social, climatic and cultural uniqueness of the region, and

Having noted examples of successful R & D work of this nature particularly the successful use of an electric motor-driven protable sprayer turbine developed locally,

Recommends that:

Efforts be made by the industrial and agricultural institutions to encourage development of new ideas and dissemination of practical results of their innovations.

42. Health hazards and environmental pollution effects of pesticides whether of industrial nature or agricultural use have received particular attention of the Workshop.

The Workshop

Having emphasized the need for adopting a cautious but realistic approach towards solving the identified inherent environmental problems without overreaction to preliminary toxicological indications;

Recommends that:

(i) The awareness of health hazards pollution abatement and precautionary measures be continuously enhanced at all levels of industrial activities and along the chain of pesticide distribution and application. Specialized training programmes should be developed and implemented with particular emphasis on recommended occupational health protection practices and theoretical toxicological aspects if and where relevant.

(ii) The industry take an active role supported by agricultural extension services which also need to be strengthened.

(iii) The pollution control and precautionary measures including effluent treatment from industrial units should be ensured.

43. With regard to the quality of pesticide formulations that well equipped and functioning quality control facilities are of paramount importance. Reliability of the results of analysis has been figured out as the prerequisite to successful quality control measures.

Having noted the need to strengthen existing quality control facilities;

Having recognized the need to develop research on new analytical procedures for identification and determination of undesirable impurities in order to keep abreast with the progress made in this field in the developed countries;

Recommends that:

(i) Exchange of experience relating to new analytical procedures and instrumentation should be promoted as a tool of accelerated specification.

(ii) Simpler and cheaper yet reliable analytical procedures be developed for purposes of quality assurance of pesticide formulation. Some analytical methods have to be developed for possible use by the end users themselves.

44. Having further recognized that there is considerable scope for improving packaging of pesticides in the region;

Having noted that this type and size of packaging containers as well as standardized labelling are important factors in the prevention of accident (poisoning) and ensurance of quality of the products;

Recommends that:

Low cost but effective and safe packaging methods be developed to meet local needs. Proper packaging materials and containers should be used and disposed according to existing standards and regulations. These packaging materials should be locally manufactured on the basis of development work to be undertaken by the pesticide industry in cooperation with the end users.

45. Having recognized the need for setting up specialized facilities for residue analysis; and

Having noted that further work will have to be conducted to establish, strengthen and augment such facilities for residue data generation in the region;

Recommends that:

(i) Governments be advised to initiate research programmes and strengthen the analytical facilities required for residue analysis.

(ii) Regional Network for the Production, Marketing and Control of Pesticides in Asia and the Pacific (RENPAF) should include among its activities a pertinent programme which would promote better understanding of the issues involved and facilitate cooperation of the government institutions entrusted with this task.

46. The Workshop acknowledged the stimulating role of the Regional Network Project and its promotional impact on cooperation among pesticide specialist of Network member countries for the region.

Having recognized the need to upgrade existing formulation facilities identify possible use of indigenous raw materials for pesticide formulations, carry out R & D newer formulations, establish/augment pesticide detecting facilities, develop skills and expertise etc.;

Having emphasized these programmes require long term efforts,

Strongly recommends that:

(i) The recommendations of the Workshop be taken into consideration by the Regional Network for the Production, Marketing and Control of Pesticides in Asia and the Pacific (RENPAF) when deciding on its work programme. It should include a number of new activities, the importance of which have been highlighted by the Workshop.

(ii) The continuation of Regional Network for the Production, Marketing and Control of Pesticides in Asia and the Pacific programme with continued support from international agencies like UNDP/UNIDO/FAO/WHO/ESCAP towards achieving project objectives.

(iii) Having recognized that the pesticide industry play a very active role in the project activities.

Conclusions:

47. The international Workshop on Pesticide Formulation proved to be very valuable in evaluating, understanding and appreciating the local developments and capabilities in the region as revealed by the country papers and expert papers of the region presented at the Workshop.

48. The Workshop helped in identifying areas of regional cooperation and future development as brought out above.

APPENDIX I

LIST OF PARTICIPANTS

BANGLADESH

Mr. MD. ABU JAFFOR MIAH
Chemist, Plant Protection Division
Department of Agricultural Extension
Farmgate, Dhaka-15

INDIA

DR. N. K. PILLAI
Research & Development Manager
Hindustan Insecticides Limited
New Delhi

Tel # 278778
TLX # 031-4628

MRS. HEMA HAYAR
Hindustan Insecticides Limited
Udyogamandal P. O. Alwaye - 685501
Cochin, Kerala State

Tel # 85, 6112, 22,23
TLX # 885-269 HILA

INDONESIA

MR. KURNIA HANAFIAH
Jl. Karang Anyar No. 55
Jakarta,

Tel. # 625979/625981

REPUBLIC OF KOREA

MR. OH, BYUNG-YOUL
Pesticide Chemistry Division
Agricultural Chemicals Research Institute
ORD, Suweon 170,
Tel # 6-6065, 5-2602

NEPAL

MR. MANGAL PRASED GUPTA
KH 1/69 Kupandol,
GPO Post Box No. 1262
Kathmandu,

Tel. No. 522155

PAKISTAN

MR. MUHAMMAD LATIF VASIR
Senior Production Manager
Ittehad Pesticides Kala Shah Kaku

Tel. No. 700410, 700128-131710971
TLX No. 44691 PL SCF PK

PHILIPPINES

MRS. CECILIA P. GASTON
Regional Coordinator, RENPAF
Fertilizer & Pesticide Authority
4th Floor, Raha Sulayman Bldg.
Benavidez St., Legaspi Village
Makati, Metro Manila,

Tel. No. 85-50-01 to 03
818-5115
TLX. No. 23176 FPA PH

MRS. ELEANOR V. DIMAUNAHAN
Senior Market Analyst
Fertilizer & Pesticide Authority
4th Floor, Raha Sulayman Bldg.
Benavidez St., Legaspi Village
Makati, M.M.,

SRI LANKA

MR. RANGITH KURUKULASURIYA
Ceylon Petroleum Corporation
Zone 3, Wellempitiya

Tel. No. 572380, 580984
Tlx. No. 21167, 21235

THAILAND

MRS. CHIRAPORN SRIPLAKICH
Department of Agriculture
Division of Agricultural Toxic
Substances,

Tel. No. 579-1577, 252-3248

UNDP/UNIDO

ESCAP

DR. H. G. R. REDDY
Rm. No. 702, United Nations Bldg.
Bangkok, Thailand

Tel. No. 2829101, 3925420
TLX. No. 82392 ESCAP TH, 82315 ESCAP TH

WHO

DR. Y. BANG
World Health Organization
I. P. Estato
Mahatma Gandhi Marg
New Delhi-110002, India

GIFAP

MR. HOWARD VAN BELL
17 B Mt. Siani Rise
Singapore 1027
Tel. No. 250-2000, 469-6803
Tlx. No. MOSIN RS 21118

DR. GERT HANSEN
Levenkusen, Schenkenoorfstr
Germany

Tel. No. 02106/511-5480,
0214/401373
Tlx. No. 85-173-525 byd

LIST OF PARTICIPANTS

OBSERVERS

INDIA

MR. AMITAVA BASU
Du Pont Far East Inc.
22, Basant Lok Community Centre
Vasant Vihar, New Delhi 110057

TLX. No. 5329
Cable : DUFE IN NEW DELHI
Tel. No. 676129, 6414958

DR. ALOK BHATTACHARYA
Development Chemist
R & D Centre, H.I.L.
Gurgaon, Haryana

DR. N. R. BHATESHWAR
Entomologist
Hindustan Insecticides Limited
R & D Centre, Dundahera, Gurgaon
Tel. No. 591347

DR. B. P. CHANDRASEKHAR
BASF India Ltd.
May Baker House, S. K. Ahire Marg
Bombay 400025
Tel. No. 422073, 596254

MR. G. CHANDRA SHEKHAR
ASST. Engineer (Chem.)
H.I.L., Hans Bhavan
New Delhi 110002

Tel. No. 272353
Tlx. No. 31-4628
Cable: HIL IN

MR. R. P. CHETTUR
D 230 Defence Colony
New Delhi
Tel. No. 616100

MR. A. S. DHANI
Hindustan Insecticides Ltd.
New Delhi

DR. S. N. DESHMUKH
MPD, R. No. 210, Hans Bhavan
Hindustan Insecticides Ltd.
New Delhi 110002
Tel. No. 278778, 504632

DR. R. S. DESHPANDE
Rallis India Limited
FANP Division, Thane Belapur Road
P. O. No. 91, Thane 400601
Tel. STD 922-8300/8692

MR. V. N. DUTTA
Hindustan Insecticides Ltd.
Hans Bhavan, B. J. Marg
New Delhi

DR. B.B. GHATGE
National Chemical Lab. of India
Poona 411008
Tel. No. 55153, 58301

KOTISWARAN, CHANDRASEKAR GANAPATI
Monsanto Chemicals of India Ltd.
Wakefield House, Sprott Road
Bombay 400038

Tlx. No. 011-3438
Tel. No. 267691, 570104

MR. R. P. LUTHRA
Technical Manager
H.I.L., Hans Bhavan
New Delhi 110002

Tlx. No. 31-4628
Cable: HIL IN
Tel. No. 272352, 5718558

MR. MADAN M. KAYASTHA
General Manager
Hindustan Insecticide Ltd.
Hans Bhavan, B. S. Z. Marg
New Delhi 110002
TLX No. 031-4628
Cable: HIL IN
Tel. No. 278778, 676668

MR. M. D. MULYE
Sandoz (I) Ltd., Kolset Thane
Maharashtra
Tel. No. 594161, 595536

MR. MUNNI LAL
H. I. L., Hans Bhavan
Wing I, B. S. Z. Marg
New Delhi

DR. NAGABHUSHAN RAO
Regional Research Laboratory
Hyderabad 500009
TLX - HYD-261
Tel. 71874

MR. A. R. PANICKER
General Manager (Corporate Planning)
H. I. L., Hans Bhavan, B. S. Z. Marg
New Delhi 110002
Tel. No. 278290, 657487

MR. Y. A. PRADHAN
Rallis India Ltd., FANP Division
P. B. No. 91, Thane Belapur Road
Thane 400 601
Tel. NO. STD 922-8300/8692

DR. RAM S. HAMSAGAR
Chairman & Managing Director
Hindustan Insecticides Ltd.
Bahadurshah Zafar Marg
New Delhi 110002
TLX No. 031-4628
Cable : HIL IN
Tel. No. 279569, 6416144

MR. N. RAJAGOPALAN
N. C. L. Pune 411008
Tel. No. 56451

MR. M. P. S. RATHI
Dy. Manager (Formulation)
M/s. Crop Health Products Pvt. Ltd.
D-31/1, Meerut Road, Industrial Area
Ghaziabad (U. P.)
Tel No. 8-43343, 8-41204, 8-40183

MR. R. B. SACHDEVA
Senior Chemical Engineer
H. I. L., Hans Bhavan, B. S. Z. Marg
New Delhi 110002
Tel No. 272353
TLX NO. 31-4628

MR. SALIL SINGAL
Managing Director
Pesticides India
Udaipur 313001
Tel. No. 5875 4056
Tlx. No. 33-20 COMP IN

DR. D. SEN GUPTA
Scientist
H. I. L. , Hans Bhavan, B. S. Z. Marg
New Delhi 110002
Tel. No. 278778
Tlx. No. 031-4628

MR. N. V. SHESHAPRASAD
Asst. Engineer (Chemical)
H. I. L., Hans Bhavan, B.S.Z. Marg
New Delhi 110002
Tel. No. 272353
Tlx. No. 31-4628

DR. SHSHIL K. KHETAN
B-5/6 Safdarjung Enclave
Africa Avenue
New Delhi 110029
Tel - GURGAON 3039, 3139
667143

MR. VISHV NATH SHARMA
Artee Minerals (Pesticides Div.)
15/7 Mathura Road, Faridabad-121002
Tel. No. 81-3369

MR. SAYOUM ALEMIL
Engineer
Epharmecor, Addis Ababa
Ethiopia
Tel. No. 432555, 441649

MR. ANOOSHIRAVAN MAHMOODI
FDPPC NO. 73, Zartosht Valiasrave
Tehran, Iran
Tel. No. 653666 - 655667-8
TLX. No. 214213 - 212814

DR. ASHOK HARISH MANCHANDA
Tropical Development & Research Inst.
London Road, SLOGH SL3 7HL
Berkshire
Tel. - SLOUGH 34626, 01-997-2534

DR. KAWAL DHARI
Manager, Product Development
Hindustan Insecticides Limited
Hans Bhavan, B. S. Z. Marg
New Delhi - 110002
Tel. No. 278778
Tlx. No. 31-4628
CABLE INSECTICIDE

MR. C. B. MANN
Deputy Technical Manager
H. I. L., Hans Bhavan, B.S.Z. Marg
New Delhi-110002
Tel. No. 272353
TLX. No. 31-4628

UNIDO/IO.594

Readex
Fiche

Distr.
LIMITED

UNIDO/IO.554
29 August 1984

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ENGLISH

Regional Network for the Production,
Marketing and Control of Pesticides
in Asia and the Far East
DP/RAS/82/006

Experts Group meeting on Quality
Control of Pesticides*

Dhaka, Bangladesh 13-17 May 1984

REPORT**

---

* Organized by the United Nations Industrial Development Organization in cooperation with Food and Agriculture Organization of the United Nations.

**Prepared for the Member Countries of the Network and other participating countries of the Region. This document has been reproduced without formal editing.

V.84-89563

CONTENTS

		Page
-	Introduction	1
-	Opening of the Meeting	2
-	Election of Officer	3
-	Adoption of Agenda	3
-	Presentation of Country Papers	3
-	Status of Quality Control Measures among Member Countries of the Network	3
-	Liaison with International Organizations	4
-	Quality Control Practices and Methodologies	4
	A. Scope	4
	B. Facilities/Equipment	5
	C. Mechanism for Developing/Adopting Specifications	6
	D. Qualifications/Training of Laboratory Personnel	7
-	Regional Scheme for Standardization of Quality Control of Pesticides and Analytical Methods	8
-	Closing of the Meeting and Adoption of the Report	11
Appendix 1	List of participants	12
Appendix 2	Expert Group Meeting on Quality Control of pesticides Agenda	20
Appendix 3	Summary of Country Paper	21
Appendix 4	Status of Quality Control of Pesticides in Participating Countries of the Network	30
Appendix 5	Some Information Concerning CIPAC	36
Appendix 6	Scope of Quality Control Practices	40
Appendix 7	Specifications	49
Appendix 8	Quality Control Laboratories/ Facilities and Equipment	50
Appendix 9	Fifteen Most Commonly used Pesticides in the Participating Countries	53
Appendix 10	Ten Pesticides Recommended For Collaborative Studies and method of Analysis followed by Participating Countries	54
Appendix 11	Proposed Lead Countries and Collaborating Countries for Collaborative Trials of Analytical Methods	55
Appendix 12	Proposed Workplan for the Sub-Network on Quality Control	56

INTRODUCTION

1. The Experts Group Meeting on Quality Control of Pesticides organized by the United Nations Industrial Development Organization in cooperation with the Food and Agriculture Organization of the United Nations and the Ministry of Agriculture, Government of the People's Republic of Bangladesh, was convened at Sonargaon Hotel, Dhaka, Bangladesh, from 13 to 17 May, 1984.

2. The Meeting was organized as an implementation of one of the activities under the work programme approved by the Technical Advisory Committee (TAC) of the Regional Network project. The Experts Group Meeting has the following objectives:

   2.1. To exchange experience in quality control methodologies and practices generally applied in the region with emphasis on identified needs for introducing new techniques if necessary;

   2.2. To identify specific areas of pesticide quality control measures, which call for joint efforts and initiation of developmental work in the region based on co-operative arrangements in this field among countries;

   2.3. To identify facilities and expertise existing in the region suitable for undertaking studies on new quality control methodologies and techniques, with the aim of establishing a regional collaborative system which would warrant steady and coordinated development in the future, taking into account related work conducted by other professional and international organizations;

   2.4. To identify specific pesticides of key importance, widely used in the region, and to compare their specifications as well as currently used analytical methods, with the ultimate aim of promoting standardization of quality control parameters and adopting common specifications;

   2.5. To plan specific activities in the field of quality control of pesticides to be pursued on a regional cooperative basis which may need strengthening through support by and liaison to be maintained with relevant international organizations and institutions.

3. The Meeting was attended by 11 delegates representing their respective governments, 2 representatives from UNIDO, Dhaka, 2 representatives from international organizations, CIPAC and GIFAP, 1 from the Regional Coordination Unit, and 28 observers from trade, industry, research organizations and affiliated Bangladesh Government departments. No participants attended from Indonesia, Sri Lanka and Afghanistan. The list of participants is attached as Appendix I.

4. The proceedings of the Meeting are summarized below.

OPENING OF THE MEETING

5. The Meeting was inaugurated by the Honourable A.Z.M. Obaidullah Khan, Minister of Agriculture, who emphasized the need for continuous review of the quality of pesticides in order to ensure their efficacy and safety to the users. He stressed the fact that although pesticides are needed for crop protection, they are not without harmful effects. It is therefore essential that the quality of such products be thoroughly checked in order to minimize possible health hazards. He advised the participants to deliberate on problems related to quality control and wished them a successful Meeting.

6. Mr. S.A. Mahmood, Director General, Department of Agricultural Extenstion, in his address, extended a warm welcome to the delegates while he stressed the importance of quality control of pesticide products. He expressed confidence that through the meeting the countries in the would benefit through exchange of experiences in quality control methodologies and practices in the field of pesticides as well as through expert evaluation of the latest techniques developed in the more advanced countries.

7. Mr. A. M. Anisuzzaman, Secretary of Agriculture and Forest Division, in his address, expressed his personal concern on the subject of quality control of pesticides. The Ministry of Agriculture is often beset by complaints from farmers, extension staff, politicians and the media on adulteration of pesticides and other problems related to their efficacy and quality. He advised the Meeting that quality control should not be considered in isolation but rather in its physical, social and economic setting. Effective quality control must be seen throughout the plant protection system, from pesticide manufacture, purchasing, distribution and storage, through an efficient plant protection service for farmers. He cautioned the Meeting that during the deliverations, the participants should not become over-absorbed in abstruse theory and high technology but to bear in mind the small farmers who use the end-product of such technology. The farmer needs pesticides that are fool-proof at his end; he needs a service that can identify when pesticides have been tampered with, or have lost their potency for other reasons, so that eventually he may be satisfied with the reliability of the product he buys.

8. Mr. V. C. Lavides, UNIDO Senior Industrial Development Field Adviser, in his statement, emphasized the support of UNIDO and UNDP to the Regional Network project and stressed the importance of quality control of pesticides in this region which is basically dependent on agriculture. He expressed appreciation to the Host Government in organizing this activity and wished for a successful conclusion of the Meeting.

9. Mrs. Cecilia P. Gaston, Regional Co-ordinator of the Network briefed the Meeting on the importance of the activity on quality control of pesticides and congratulated the Government of Bangladesh for having successfully implemented an effective system of quality assurance of pesticide products.

She welcomed the delegates for a fruitful meeting and urged them to carry out the recommendations arrived at during the deliverations so that in the next few years standardized methodologies can be adopted by all member countries of the network.

10. Mr. D. U. Khan, Director, Plant Protection Wing, Department of Agricultural Extension proposed vote of thanks on behalf of the organizers.

ELECTION OF OFFICERS

11. Mr. Dalil Uddin Khan (Bangladesh) was elected Chairman, Mr. M. M. H. Baig and Dr. N. K. Pillai (India), Rapporteur for the Meeting.

ADOPTION OF AGENDA

12. The Meeting adopted the agenda as presented in Appendix 2.

PRESENTATION OF COUNTRY PAPERS

13. Delegates from 7 participating countries presented papers on the status of quality control measures and methodologies in their respective countries together with their proposals for inter-country regional cooperation in this field. The papers included descriptions of quality control practices applied at production site and distribution chain; equipment and adoption of specifications; methods of analysis, training of personnel; problems and proposals for inter-country cooperation. A summary of each paper is attached as Appendix 3.

STATUS OF QUALITY CONTROL MEASURES AMONG MEMBER COUNTRIES OF THE NETWORK

14. Dr. N. K. Pillai (India), one of the resource speakers presented his observations on quality control measures in 7 of the member countries which he visited as a recipient of the study tour grant from the Network. Mr. Ruhul Amin (Bangladesh) added his views on the situation in Sri Lanka and Afghanistan, where he was a consultant under the auspices of the Network. In general, their findings concur with those reported by the delegates.

15. Bangladesh has the most rigid quality control practices with enforcement done by the government at the point of entry, during production and in the distribution chain. The Bangladesh Standards Institution has adopted with some modifications FAO/WHO specifications utilize CIPAC and AOAC methods of analysis. Korea relies heavily on the self-inspection system imposed by manufacturers and the NAMIO which sets standards specifications using basically FAO guidelines. The Indian Standards Institution has adopted specifications for

pesticides which are more or less similar to that of FAO. Monitoring of quality control is done by the Government with the Central Insecticide laboratory providing advice in cases of dispute. Pakistan has started to adopt national standards. The rest of the countries, Philippines, Thailand, Nepal - currently have no national standards. However, all are contemplating on adopting FAO/WHO specifications. All, except Nepal monitor quality control in both pre and post distribution stages. Summaries of the reports of Dr. N. K. Pillai and Mr. Ruhul Amin are attached as Appendix 4.

LIAISON WITH INTERNATIONAL ORGANIZATIONS

16. Dr. J. Henriet, CIPAC Chairman and resource speaker for the Meeting, presented a paper providing basic information on the work of CIPAC, FAO, WHO in the field of pesticide specifications and methods of analysis. He expressed interest in the activities of the Network in this field and invited member countries to join in CIPAC collaborative laboratory trials. He also encouraged member countries of the Network to bring to the attention of FAO WHO and CIPAC specific requests and problems for pesticides extensively used in this region which have no FAO or WHO specifications and where CIPAC or AOAC methods are not available. A copy of Dr. Henriet's paper is attached as Appendix 5.

17. Mr. Roger J. Parker, (GIFAP), discussed the views of GIFAP on quality control of pesticides and presented excerpts from a proposed publication of GIFAP entitled "Guidelines on Pesticide Quality Control."

18. In this document emphasis is placed on two aspects of Quality Control which are important from both the industrial and regulatory viewpoints. The provision of defined manufacturing systems and procedures is of paramount importance together with effective analytical testing programmes in the laboratory.

Manufacturing systems described cover, organization, training design of plant and documentation. In the laboratory, emphasis is placed on the design and layout, organization, working systems and documentation. GIFAP recommends that the FAO guidelines be used for drafting specifications. It is essential that the specifications tests should be realistically applied however. For chemical analysis, chromotographic methods are favoured and in particular the advantages of HPLC methods in terms of flexibility and range of application is stressed.

QUALITY CONTROL PRACTICES AND METHODOLOGIES

A. SCOPE

19. A technical product of a pesticide active ingredient is rarely suitable to be used as such in the field. It has to be formulated. Formulation involves at a set of processes consisting mainly of converting an active ingredient into

a form which enhanced maximum biological efficacy in a given application technique, while remaining in acceptable economical limits. Formulation is an art and this explains why different commercial products based on the same active ingredient content behave differently in the field. The aim of quality control therefore is to ensure that the physical and chemical characteristics of a commercial product would satisfactorily be effective in the field and safe for end-users to apply. Quality control must be based on two aspects: a) the chemical aspect, consisting of checking the active ingredient content and harmful impurities; and b) the physical aspect, consisting of checking conformity of physico-chemical properties of the product with the application technique. (Appendix 6A)

20. The quality control practices and methodologies currently employed among participating countries are summarized in Appendices 6 and 7. There was a general concensus in the meeting that as far as possible, FAO/WHO specifications be used as guide in determining national standards and whenever available the corresponding CIPAC and AOAC methods of analysis be followed.

B. FACILITIES/EQUIPMENT

21. The Meeting noted that all participating countries have the basic facilities required for pesticide formulation analysis. However, there is a need for strengthening existing facilities and regional cooperation should be expored along these lines. Appendix 8 idenfifies government quality control organizations, laboratories, facilities and equipment as well as those available from manufacturers or formulators and other agencies.

RECOMMENDATION

The Meeting,

Having noted that although some facilities for quality control are generally available among the member countries, there are specialized instruments available only in a few;

Recognizing that some countries may not have the facilities available to analyze certain samples while others are in a better positionto do so.

Recommends that in cases where a member country may require some special analysis of a pesticide product for which no adequate facilities are available in that country, then any other member country better equipped and trained to do so, should whenever practicable, assist in analyzing the sample in line with strengthening of regional cooperation.

C. MECHANISM FOR DEVELOPING/ADOPTING SPECIFICATIONS

22. The mechanism for development of FAO specficications for pesticides was explained and discussed. FAO issues three classes of specifications:

a) Draft specifications: those submitted for consideration;

b) FAO provisional specifications: those which may require further work;

c) FAO specifications : those which are fully acceptable on the basis of evidence presented.

Draft specifications are submitted by any organization or person for consideration by the FAO Group of Experts on pesticide specifications, who assign a priority to it. The draft is circulated among the FAO Group of Experts and GIFAP, if it is a commodity product or to the concerned manufacturer if it is a patented product. In its annual meeting the FAO Group of Experts considers comments on the draft specifications and takes suitable action such as promotion to provisional or FAO specifications.

23. For WHO specifications, data are requested from manufacturers and these are reviewed by the WHO staff for recommendation to the WHO Expert Group which meets once in about every five years.

24. Four member countries have their respective national standard institutions who formulate National Standards for pesticides and their formulation. The National Standard Institutions have Divisional Councils and sub-committees for the formulation of pesticide standards, consisting of Experts from the industry, Government law-enforcing agencies, research organizations and representatives of the consumers. The sub-committees prepare draft standards, keeping in view available international standards like ISO, FAO, WHO US AID etc. These draft standards are circulated for comments from the members of the sub-committee and other experts in the field, including from the industry and the consumers. After incorporating the comments from the experts, provi0 sional standards are prepared with the approval of the Divisional Councils. The provisional standards are normally put to use for varying periods of time before they are accepted as final specifications. While finalizing the specifications unlike in the case of FAO specifications, the representatives of industry (who are members of sub-committee and Divisional Council) are involved in the decision making.

Whenever National specifications are not available international specifications like FAO, WHO US AID and in some cases ISI specifications are adopted in the participating countries of the region.

25. Member countries which have not as yet adopted standard specifications for pesticides were encouraged to do so, taking into consideration the use of FAO WHO specification as well as those available in the region. The need to look into common specifications was also emphasized.

RECOMMENDATION

The Meeting

Having noted the current quality control methodologies and practices employed among the member countries of the region;

Having considered the importance of adopting uniform standards for pesticide specifications in the region;

Recognizing the extensive use of FAO and WHO specifications within the region;

Further noting that in evolving national standards, FAO specifications have been used as basis in most countries wherever these are available;

Recommends that member countries of the region adopt specifications based on FAO standards wherever possible.

D. QUALIFICATIONS/TRAINING OF LABORATORY PERSONNEL

26. Considering the degree of sophistication of current methods of analysis being developed and the complex nature of pesticides, the meeting agreed that the head of a quality control laboratory or unit should be a qualified analytical chemist with sufficient experience in pesticide analysis techniques. The meeting further suggested that efforts should be taken to provide sufficient number of chemists and laboratory personnel to ensure the efficient functioning of the laboratory.

RECOMMENDATION

Recognizing the need for specialized training on the latest methods developed on pesticide formulation analysis;

Noting that some laboratories have hardly any training programmes for their personnel;

Recommends that the Regional Network organize workshops or seminars aimed at upgrading the knowledge and techniques of analytical laboratory personnel. In this activity, the training facilities availabel in the region. Such as those of the Pesticides Development Programme, India or the Philippine Institute for Pure and Applied Chemistry be taken into account.

Further recognizing that methods of analysis are dependent on the proper operation and maintenance of analytical instruments;

Further noting that in most countries no suitable training is offered on the proper upkeep and maintenance of analytical instruments;

Further recommends that suitable training programmes on operation and maintenance of analytical instruments be organized to meet the requirements of the countries. Services of experts in the concerned area of instrumentation should be made available through the Regional Network.

REGIONAL SCHEME FOR STANDARDIZATION OF QUALITY CONTROL OF PESTICIDES AND ANALYTICAL METHODS

27. The Meeting identified 15 commonly used pesticides among the participating countries and compared current specifications used (Appendix 9).

28. Out of these, ten pesticides were chosen for which specifications are available either from FAO, or member countries. The methods of analysis, currently used were indicated for each of these pesticides. The participating countries agreed to conduct collaborative trials using one of the methods chosen by the lead country (Appendix 10). The trials are aimed to ensure that common methods of analysis are used throughout the region. CIPAC shall be invited to advise in such trials while technical assistance would be solicited from the manufacturers whenever necessary.

29. In cases where there are no available methods, CIPAC should be requested to initiate collaborative studies jointly with the network member countries.

RECOMMENDATION

The Meeting,

Having noted that all participating countries have the basic facilities required for pesticide formulation analysis;

Being aware that most of the participating countries are using similar methods of analysis including those of CIPAC and AOAC wherever available;

Recognizing the considerable benefits to be derived from the use of common procedures and methods of analysis;

Recommends that standardized methods of analysis be adopted among member countries in the region using as much as possible available CIPAC and AOAC methods, and in cases where these are not available, further recommends that the Regional Network shall initiate collaborative studies in coordination with CIPAC.

CONCLUSION

30. The Meeting recognized the importance of quality control measures in ensuring that the pesticides applied are effective and safe for the intended uses;

and agreed to strengthen regional cooperation among member countries of the Network by working towards adoption of common standards and methodologies. The Meeting noted, however, certain constraints in implementing quality control practices:

a) difficulty in obtaining some required chemical reagents for analysis;

b) difficulty in procuring necessary spare parts/components for analytical instruments;

c) difficulty in ensuring availability of analytical standards.

RECOMMENDATION

The Meeting

Noting the above constraints in effective implementation of quality control measures;

Recognizing that such constraints exist in almost all countries in the region;

Suggests that the Regional Network explore the possibility of setting-up a special fund to be utilized for urgent procurement of chemicals, reagents and spare parts for use in quality control;

Recommends that the Regional Network set-up an analytical standards bank for the benefit of the participating countries, so as to supply in time with relative confidence and ensure quality control during inter-country regional trade. Support from United Nation's agencies like FAO, WHO and UNIDO is urgently requested. The cooperation of GIFAP and EPA in this regard is also essential.

31. The Meeting noted the need in some cases to analyse toxic impurities in basic pesticides as well as in formulations. However, the general consensus was that the methods of analysis and necessary standards are not always available. The Meeting was informed that while the manufacturers of the basic pesticides are expected to have carried out studies in this area, the US-EPA might be able to provide useful guidelines on methodology. The Meeting advised the countries interested, to seek guidance of EPA through the Regional Coordination Unit.

32. The need to incorporate mutually acceptable packaging and storage guidelines together with the standard specifications was stressed. However, the Meeting noted that only Korean and Inida currently have specifications for pesticide packaging. The Meeting suggested that such specifications on packaging be circulated to other member countries by the Regional Coordination Unit so that the matter can be thoroughly reviewed and considered firstly on a national level and eventually on the regional level.

33. With the introduction of new varieties of pesticide products, methods of analysis are continuously being improved and revised. Although these informations are available either from international organizations like CIPAC and AOAC or from the manufacturers, they are not generally accessible to the member countries and hence not fully utilized.

RECOMMENDATION

The Meeting

Having noted that considerable information on new and improved methods of analysis are available;

Recognizing the difficulty in some cases of obtaining such information on a regular basis;

Further noting that the countries in the region are continuously evolving national standards for specifications of pesticides;

Further recognizing the benefits to be derived from mutual exchange of information on quality control measures among member countries;

Recommends that the Regional Coordination Unit includes among its responsibilities, the retrieval and dissemination of relevant information on pesticide specifications, methods of analysis, packaging and quality control practices.

34. In general, the participating countries agreed to adopt whenever practicable FAO and WHO specifications for pesticides and utilize CIPAC methods of analysis. The Meeting however noted that FAO specifications and CIPAC methods are not available for some of the pesticides considered important in the region. Appendix 9 illustrates this point clearly.

RECOMMENDATION

The Meeting

Recognizing the value of using FAO specifications and CIPAC methods of analysis;

Noting that in the above cases some FAO specifications and CIPAC methods are not available;

Recommends that the Regional Network urgently draw to the attention of FAO and CIPAC the above cases and urge both FAO and CIPAC to give immediate consideration to establish specifications and methods of analysis for pesticides recommended by this Meeting.

Further noting that some of the available FAO specifications may need updating and revision;

Further suggests that the Regional Network request FAO to give due consideration to revision of specifications for the pesticides identified as above; and

Further recommends that Network member countries take active participation in this field, particularly in carrying out collaborative studies with CIPAC aimed at developing and standardizing methods of analysis, taking into account availability of instruments among member countries.

35. In consideration of the requirements of individual participating countries, and in an effort to initiate activities for the sub-network on quality control, the Meeting prepared a work plan for a period of two years. The details are presented in Appendix 12. The Meeting recommended that the proposed work plan be considered by the forthcoming TAC.

CLOSING OF THE MEETING AND ADOPTION OF THE REPORT

36. The Chairman summarized the proceedings and recommendations of the Meeting and finally closed the Meeting after the Report was adopted as amended.

LIST OF PARTICIPANTS

Country Representatives

BANGLADESH

D. U. KHAN (Chairman)
Director, Plant Protection Wing
Department of Agriculture Extension
Khamarvari, Dhaka-15
Tel. 327047

A. R. KHAN
Additional Director
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Tel. 327048

S. A.KHAN
Deputy Director
Pesticide Administration and Quality Control
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Tel. 326087

MD. RUHUL AMIN
Senior Chemist
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Tel. 327171

INDIA

P. V. KRISHNA
Adviser (Chemicals)
Ministry of Chemical and Fertilizer
Government of India, Shastri Bhavan
Dr. Rajendra Prasad Road
New Delhi, 110001
Tel. No. 386047

KOREA

YOUNG HO. JEONG
Agricultural Chemicals Research Inst.
Suweon,
Tel. No. 6-6605

NEPAL

DINESH RAJ BHATTARAI
Director
Nepal Bureau of Standards
Dillibazar, Kathmandu

Tel. No. 216619

PAKISTAN

M. M. M. BAIG (Vice-Chairman)
Principal Scientific Officer and
Government Analyst
Federal Pesticide Research Laboratory
PARC, Karachi-27

Tel. No. 482712

PHILIPPINES

MA. THELMA A. ANTAZO
Chief, Pesticide Analytical Laboratory
Bureau of Plant Industry
San Andres, Manila

Tel. No. 598540

THAILAND

PATANAN SANGKATAWAT
Chief, Pesticide Regulatory Section
Agricultural Regulatory Division
Department of Agriculture
Bangkok,
Tel. 5794652

Resource Persons

JEAN HENRIET
CIPAC Chairman
Station De Phytopharmacie
Ministry of Agriculture
Rue Du Bordia 11, Belgium
Tel. 081612971

ROGER J. PARKER
GIFAP Chairman
ICI Plant Protection Division
Yalding, Kent ME 18 6 HN
United Kingdom
Tel. No. (0622) 812511

N. K. PILLAI
Research and Development Manager
HIL R & D Centre
Udyogvihar, Gurgaon, Haryana
India
Tel. 3089 or 3189

Observers

NAZRUL ISLAM
Entomologiest
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

NILUFAR SANAULLAH
Plant Pathologiest
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

A. K. M. AZAD
Technical Officer
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

ABDUS SALAM BHUIYAN
Chemist
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

A. S. MOSHARRAF HOSSAIN
Assistant Director
Agriculture Extension
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

SYED ZAHIDDUZZAMAN
Aerial Pest Control Officer
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

TASLIMUDDIN SARKER
Deputy Director
Bangladesh Standards Institution
3 DIT (Ext) Avenue
Motijheel Commercial Area, Dhaka-2
Bangladesh

REZANUZZAMAN CHOWDHURY
Entomologist
Bayer (Bangladesh) Ltd.
39 Dilkusha Commercial Area
Dhaka, Bangladesh

CHOWDHURY FAZLE IMAM
Quality Control Manager
Ciba-Geigy (Bangladesh) Ltd.
Pesticides Plant
10/11 Sholashahar L. I. Area
Chittagong, Bangladesh

SIRAJUDDIN AHMED CHOWDHURY
Dy. Manager AIOP
ICI Bangladesh Manufacturers Ltd.
9 Motijheel Commercial Area
Dhaka-2, Bangladesh

MAFIZUL HAQUE KHAN
Principal Scientific Officer
Bangladesh Agricultural Research Council
Farmgate, Dhaka
Bangladesh

M. A. JALIL
Director
Shetu Corporation Ltd.
Amin Court, 62-63 Motijheel
Dhaka, Bangladesh

A. B. A. SIRAJ UDDOWLAH
Chairman, Pesticide Association
of Bangladesh
Hadi Mansion (3rd Floor)
2 Dilkusha CA, Dhaka-2
Bangladesh

MD. ABU JAFFOR MIAH
Chemist, Pesticide Control Laboratory
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

MD ASADUL HUQ
Area Chemical Officer
61-63 Motijheel Commercial Area
Amin Court (1st Floor)
Dhaka, Bangladesh

SYED AKHTER HOSSAIN
Quality Control Manager
ICI Bangladesh Manufacturers Ltd.
Water Works Road, Narayanganj
Dhaka, Bangladesh

MOSTAFA ABDUR RAHMAN PAIKER
In-Charge, Pesticide Division
Krishi Banijya Protisthan
Dhaka, Bangladesh

MD. SERAJUL ISLAM
Entomologist
BASF (Bangladesh) Ltd.
ALICO Bldg., 18-20 Motijheel
Dhaka, Bangladesh

MD. ABDUL JABBAR
Asst. Rodent Control Officer
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

KH. MD. LUTFAR RAHMAN
Asst. Rodent Control Officer
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

MURSHED JAHAN
Junior Research Officer, Pesticide Laboratory
Plant Protectinn Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

SYED MD. ZAINUL ABEDIN
Asst. Rodent Control Officer
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

MD. AMIRUL ISLAM
Area Chemical Officer
Jamuna Oil Co., Ltd.
62-63 Motijheel, Dhaka
Bangladesh

JYOTIRINDRACHANDRA SAHA CHOWDHURY
Scientific Expert, CIBA-GEIGY LTD.
50 Dhanmandi Residential Area
Road No. 2 A, Dhaka-9
Bangladesh

CHATREE PITAKPAIVAN
Technical Manager
ICI Asiatic (Agriculture) Co. Ltd.
53-55 Oriental Avenue
Bangkok, Thailand

A.C. VAN ELSEN
Project Manager
Bangladesh-German Plant Protection Programme
P. O. Box 6011 Gulshan, Dhaka
Bangladesh

M. M. HOQUE
Agrochemical Marketing Manager
Bangladesh Pharmaceutical Industry Ltd.
29 Topkhana Road, Dhaka
Bangladesh

UN Agencies and Organizers

CECILIA P. GASTON
Regional Coordinator, RENPAF
Deputy Administrator for Pesticides
Fertilizer and Pesticide Authority
Benavidez Street, Makati, Metro Manila
Philippines

VICENTE C. LAVIDES
Senior Industrial Field Development Officer
UNIDO, Dhaka
Bangladesh

ROBERT PETRI
Junior Programme Officer
UNIDO, Dhaka
Bangladesh

Secretariat

REZIA SALAM
Administrative Asst, UNIDO/UNDP
UNIDO Project BGD-75/013
Bangladesh Jute Research Institute
Manik Mia Avenue, Dhaka
Bangladesh

MD. SAFIULLAH BISWAS
Stenographer
Plant Protection Wing
Department of Agriculture Extension
Khamarbari, Dhaka-15
Bangladesh

SYED ZIAUDDIN AHMAD
Stenographer
Field Service Wing
Department of Agriculture Extension
Khamarbari, Dhaka
Bangladesh

MD HAZRAT ALI
Stenographer
Director-General's Office
Department of Agriculture Extension
Khamarbari, Dhaka
Bangladesh

MD. SIRAJUL ISLAM
Steno-typist
Administration & Personnel Wing
Department of Agriulture Extension
Khamarbari, Dhaka
Bangladesh

EXPERTS GROUP MEETING ON QUALITY CONTRO OF PESTICIDES

AGENDA

1. Opening
2. Election of Chairman/Appointment of Rapporteur
3. Adoption of Agenda
4. Presentation of Country Papers
5. Status of Quality Control Measures in Member Countries
6. Liaison with Internation Organizations (CIPAC, AOAC, FAO, WHO, GIFAP)
7. Quality Control Practices/Methodologies:
   - 7.1 Scope
   - 7.2 Equipment and Facilities
   - 7.3 Mechanism for adopting or developing specifications
   - 7.4 Analytical methods and mechanism for standardization
   - 7.5 Training of laboratory personnel
8. Regional standardization of Methodologies
   - 8.1 Identification of key pesticides used in the region
   - 8.2 Current methods of analysis
   - 8.3 Current specifications used
   - 8.4 Constraints and possible solutions
9. Regional Scheme for Standardization of Quality Control of Pesticides and Analytical Methods
10. Other Business
11. Adoption of Report
12. Closing Session

SUMMARY OF COUNTRY PAPER

BANGLADESH

The registration of pesticide is a statutory requirement in Bangladesh, and is governed by the Agricultural Pesticide Ordinance, 1971 and the Amendments made in 1980 and 1983. The process of registration is based on test results of physico-chemical properties carried in the pesticide Laboratory of Plant Protection and also on the results obtained after biological experimentation under Laboratory and field conditions conducted in different Research Institutions. So far, 115 pesticide formulations have been standardized and registered in the country, of which about 30% are locally formulated and the rest being imported.

Formulation plants have their own laboratories for production quality control, and follow mostly conventional methods. The Pesticide Laboratory of Plant Protection is the only regulatory laboratory in the country for testing of pesticides for registration and quality control purposes of the products marketed through about 20,000 licensed dealers.

Generally, FAO specifications for pesticides and analytical methods as outlined in CIPAC Handbooks are followed. Where not available, other international specifications and analytical methods are accepted.

About 470 technical officers stationed at Upa-Zilla level are appointed as pesticide Inspectors under the provisions of the ordinance for the purpose of inspection and execution of the regulations.

Commonly used pesticides are malathion, fenitrothion, phosphamidon, diclorvos, dimethoate, dieldrin, diazinon, fenthion, copper oxychloride, 2,4-D Sodium salt, paraquat dchloride and zinc phosphide.

The sampeles collected by inspectors and other authorized persons are referred to the Pesticide Laboratory for testing. The Government Analyst appointed under the ordinance, analyses or causes to be analyzed these samples and submits reports to the agency concerned in prescrived form for appropriate action.

Laboratory analyses have shown up defects and mistakes in formulations, packing or repacking materials or labels, whether they were accidental or intentional.

Regional cooperation in the field of uniform specifications, analytical methods, exchange of information on new methodology and one common source of analytical standards deserves utmost consideration.

For efficient quality control scheme suitably qualified and skilled staff members having wide working experience in solving analytical problems are essential. Such staff members need to be specially trained and treated so that each one of them is convinced that there is something he can do in his daily work to contribute to the quality control programme of the government.

SUMMARY OF COUNTRY PAPER

INDIA

The Pesticide Industry in India is fairly well-established. The present consumption of Pesticides in Agriculture and Public Health is of the order of 60,000 MT technical grade material. The demand analysis of pesticides in India indicates that about 81% of the total demand constitutes insecticides, 14% fungicides, 2.4% herbicides, 1.3% rodenticides and fumigants and 1.3% other pesticides.

The production of pesticides in India is largely in the private sector. The major producer of pesticides in the public sector is Hindustan Insecticides Ltd. There are about 32 large industrial units engaged in the manufacture of about 50 technical grade pesticides. There are over 400 small scale formulators in the private sector. The estimated total pesticides formulation capacity in India is of the order of 1.6 million MT of formulated products. Out of this total formulation capacity, 10-15% is estimated to be in the organized sector and the remaining in the small scale sector.

The manufacture, import, sale, transport, distribution and use of pesticides in India are regulated by the provisions of the Insecticides Act 1968 and Insecticides Rules 1971. All pesticides are required to be registered under the provisions of the Act and Rules.

All technical matters pertaining to insecticides till the grant of compulsory registration is the central responsibility of the statutorily constituted bodies like Cental Insecticides Board and the Registration Committee.

The Central Insecticide Laboratory functions as the statutory laboratory to verify the claims made by the manufacturer or formulator at the time of registration.

The Central Insecticides Laboratory has already been established with four technical divisions namely: i) Bioassay Division, ii) Toxicology and Pharmacology Division, iii) Pesticide Residues and Quality Control Division, iv) Packaging and Processing Division.

The enforcement of various provisions of the Insecticides Act lies with the State Goverments and Union Territories. Accordingly, the States and Union Territories have appointed all the principal functionaries namely: Licensing Officers, Insecticide Inspectors and Insecticide Analysts to discharge various prescribed duties. There are 31 pesticide testing laboratories in 16 States and one Union Territory. Three more laboratories are being established.

The Government of India has recently approved setting up of 5 regional Pesticide Testing Laboratories for quality Control. Action has been initiated to set up these units.

Indian Standards Institution is operating certification mark scheme under which manufacturers are licensed to use the ISI mark on goods produced by them in conformity with the relevant Indian Standards. It is obligatory on the part of the manufacturer to have the ISI mark, but the ISI mark is a third party assurance for the quality of the product. ISI has a Central Laboratory at Delhi and regional laboratories at Bombay, Madras and Calcutta.

Indian Standard specifications are generally adopted as standard specifications for pesticides in India. Indian Standards specify methods of analysis and sampling procedures also. Wherever Indian Standards are not available, internation specifications like FAO, WHO, etc. are followed. Samples of analytical standards are supplied by ISI in some cases. Standard samples are also obtained from EPA and other internationa agencies. Action is on hand for making available standard analytical samples indigenously.

Quality contrcl facilities are fairly adequate at the manufacturers' end, especially those engaged in the manufacture of technical grade pesticides. Quality control facilities with the small scale formulators need improvement in some cases.

Pesticides Development Programme, India, a UN- aided project being implemented by Hindustan Insecticides Ltd. on behalf of the government of India had built up the necessary infrastructure for quality control of pesticides and training the personnel engaged in quality control work. The activities of the project have already been started.

Other agencies associated with pesticide analysis and quality control are private organizations like Sri Ram Test House, Industrial Testing and Analytical Laboratory, etc., National Test House under the Ministry of Commerce, National Laboratories under CSIR and Pesticide Analysis Labor - tories attached with various agricultural universities.

Proposal for intercountry regional cooperation in the field of quality control has been included.

SUMMARY OF COUNTRY PAPER

KOREA

Quality control of pesticides in Korea is regulated by Pesticide Management Law and it is basically responsible for the formulators themselves. The Pesticide Management Law prescribes in detail the inspection procedures, specifications, equipment and facilities for pesticide quality control.

1. Persons and Facilities required for Quality Control of Pesticides:

In order to ensure the quality control of pesticides, we have legally established the criteria of the persons who engage in the pesticide manufacturing business, and the facilities required for manufacturing the pesticides.

Person who intends to conduct manufacturing of pesticides shall major in agricultural chemistry, chemistry, chemical engineering or biology in a 4 year college and graduate therefrom according to the Educational Law, or persons who obtain a license of pharmacist according to the Pharmacist Law.

Pesticide manufacturing business have to insure the acreage of laboratory and experimental field, and laboratory equipment regulated by Pesticide Management Law.

2. Inspection criteria of Pesticides for Quality Control

We have three ways of inspection procedures for quality control of pesticides, that is self-inspection, applied inspection and ex-officio inspection. And also, we have 3 inspection methods, that is, external inspection, physico-chemical inspection and biological inspection.

Concerning the quality control of pesticides, National Agricultural Materials Inspection Office (NAMIO) is a major adimistrative organization in Korea. This agency conducts ex-officio inspection of pesticides periodically and applied inspection for request of pesticide manufacturers.

When the pesticides have been judged "Rejectable" as a result of physico-chemical inspection and biological tests, the manufacturer can raise objection thereto within 15 days from the date of notification of the result of the inspection. The Director of NAMIO may conduct re-inspection on the pesticides claimed by the manufacturer.

3. Method of Inspection:

   a. External inspection

      For all samples taken on the basis of complete randomized sampling method, external inspection shall be made with regard to condition of packaging, description of label, adhesion of inspection stamp and weight.

   b. Physico-Chemical Inspection

      The Director of NAMIO shall conduct physico-chemical test in accordance with publicly announced method "NAMIO Analysis Method" within one month from the date of sampling.

      Method of analysis of active ingredient are available for all the formulations registered in Korea except antibiotics and microbial insecticides. The method of physico-chemical analysis are used NAMIO method which was modified the specification of WHO, CIPAC and other international organizations.

4. Most Common Pesticide in Korea

   IBP, edifenphos, probenazole, isoprothiolane, mancozeb, phenthoate, cartap, fenthion, diazinon, BPMC, EPN, dichlorvos, butachlor, benthiocarb and alachlor which are applied over 200 MT active ingredient basis in 1982.

5. Proposals for intercountry regional cooperation in quality control

   a. to establish the analytical standard bank

   b. to prepare the analysis specifications of the impurities in technical material

SUMMARY OF COUNTRY PAPER

NEPAL

There is no separate regulation for manufacturing, importing and distribution of pesticides in Nepal. Partly, it is governed by the Drug Act. No national standard specifications have been stablished yet. The Nepal Bureau of Standards is responsible for it and efforts are being made to formulate the standards.

Currently, Indian Standard specifications are adopted for controlling the quality of pesticides. When the IS specifications are not available, FAO and WHO specifications are followed.

The Entomology and Plant Pathology Laboratory of the Department of Agriculture is responsible for quality control activities. Agriculture Input Corporation is mainly responsible for import and distribution of pesticides. There are only a few formulators in Nepal.

Recently, a Pesticides Board has been established. This Board is responsible for import recommendation, distribution and control of pesticides.

SUMMARY OF COUNTRY PAPER

PAKISTAN

The paper presents the fact that import of pesticides, when in public sector, was erratic (4419 MT in 1979-80 and 16225 MT in 1976-77). In private Sector since 1980, the position has estabilized and sales have doubled to over 6000 MT in 1983.

All candidate pesticides for registration are required to be cleared first by the Federal Pesticides Research Laboratory of Pakistan Agricultural Research Council before field bioefficacy tests to qualify for registration. So far 189 formulations have been registered for use.

FPRL at Karachi as well as a regional laboratory in Punjab are presently providing pre- and post-registration quality control which is largely voluntary. Similar facility exist with the only operational manufacturing unit. For monitoring purposes, 5 more regional laboratories are in the process of establishments. For undertaking the job, the FRPL is equipped with MPLC, GLC, IR, UV and TLC facilities.

National specifications of pesticides in association with Pakistan standards Institution, and the trade and with reference to FAO and WHO and similar international standards are being framed (28finalized and 54 under process). CIPAC test methods are generally followed.

Fifteen pesticides most commonly used during 1983, with sales in three figures, are: Monocrotophos, BMC, DDT, Diazinon, Disulfoton, Endrin, Hostathion, Lorsban, Methyl Parathion, Dimecron, Polytrin-C, Endosulfan, Thimet, Zolone DT, Sumithion, Sevin, Sevidol, Sumicidin, Padan and Antracol.

SUMMARY OF COUNTRY PAPER

PHILIPPINES

An important aspect in pesticide applications is a well-standardized pesticide formulation. Reports of sub-standard or adulterated pesticides in the hands of farmers, particularly vegetable farmers, and subsequent overdosing for "effective" control has prompted the need for a program to monitor batches in formulation plants and to check the quality of pesticides on dealers' shelves and farmers' residual samples. This special concern is in recognition not only of the economic importance of these products in agriculture and public welfare, but of the potential hazards they present.

The Fertilizer and Pesticide Authority was created in 1977 to regulate the importation, exportation, manufacture, formulation, distribution, sale transport, storage, use and disposal of pesticides. For all formulation and residue analyses requirements, the FPA utilizes the facilities of the Pesticide Analytical Laboratory of the Bureau of Plant Industry.

There are a few formulators, the small-scale single product mixers, who practice very little quality control, but most larger formulators maintain their own laboratories and have developed quality control systems.

At the production site, quality control begins with inspection and analysis of incoming raw materials and packaging materials. Only materials which conform to company specs are accepted and used. For formulated products, a batch sample is analyzed and if found to meet established specs, approval is given to refill into desired container. During the refilling process, constant inspection is conducted to be able to spot faults during production: improper fill, poorly affixed labels, and anything that will create a marked reduction in quality.

As a regulatory laboratory, the BPI Pesticide Analytical Laboratory is responsible for checking conformity to registered specifications and monitors quality of formulations in the market. The scope of activities in this unit include: checking whether the identity, purity and concentration of the active ingredient in a pesticide product is as stated; checking whether the physical properties like appearance, emulsion stability, viscosity, alkalinity/acidity, specific gravity, particle size, flowability and wettability, conform with the minimum requirements; and investigating storage stability under local climatic conditions.

The most commonly used pesticides in the country are: butachlor, carbofuran, chlorothalonil, methomyl, monocrotophos, mancozed, thiophanate methyl, BPMC, carbaryl, diazinon, malathion, MIPC, paraquat dichloride, azinphos ethyl, and endosulfan. Analysis is made with specialized equipment like gas chromatographs, high pressure liquid

APPENDIX 4

Status of Quality Control of Pesticides in Participating Countries of the Network

Based of the Study Tour of N.K. Pillai on Quality Control in Philippines, Korea, Thailand and Pakistan, his visit to Indonesia and Bangladesh and the visit of Ruhul Amin to Afghanistan and SriLanka

Dr. N.K. Pillai, India, undertook a study tour in Philippines, Republic of Korea, Tahiland and Pakistan from July 17 to August 14, 1983 to study the Quality Control Practices in these countries. Mr. Preecha Chupanish, of Tahiland and Mrs. Emi of Indonesia were in the study tour team in Philippines, Korea and Pakistan. Mr. Ruhul Amin of Bangladesh was in the study tour team in Philippines and Korea, while Mr. S.A. Khan of Bangladesh undertook the tour of India and Pakistan. While the rest of the memberof the team were in India, Mr N.K. Pillai undertook the study tour of Thailand. Salient points in each country as follows:

PHILIPPINES

Fertilizer and Pesticide Authority is the regulatory agency of the government for pesticides. Responsible for registration, licensing and regulatory activities commencing manufacture, imports, distribution and sale of pesticides. Mostly pesticides requirement met by imports and local formulation of imported technical material. Twenty-two (22) formulation units are functioning in the country. Quality control and residue analysis carried out at the Pesticide Analytical Laboratory of the Bureau of Plant Industry, sister concern of FPA. Analytical facilities available are good, including 7 gas chromatographs with various detectors, HPLC, IR and UV spectrophotometers and TLC run by qualified chemists. More trust given to residue analysis than quality control only active control analysis monitored. Has three (3) satellite Laboratories in other parts of the country. Visited a few formulation manufacturing units. Quality control facilities available with the industry are fairly good, including gas chromatographs and HPLCs. No uniform specifications from the suppliers of the active materials and also FAO/WHO specifications. Some formulation units are housed in the same campus with pharmaceuticals.

REPUBLIC OF KOREA

The pesticide committee of the Ministry of Agricultural and Fisheries is the regulatory authority on pesticides in Korea. The Agricultural Chemical Research Institute of the office of Rural Development responsible for R & D of pesticides Bioefficacy, Toxicity and residues studies, while National Agricultural Material Inspection Office responsible for quality control and quality assurance of pesticides. Pesticides requirement met mostly by indigenous manufacture and to limited extent formulation of imported active materials. Seventeen (17) units

SUMMARY OF COUNTRY PAPER

THAILAND

Pesticides used in Tahailand, with exception to locally manufactured paraquat are totally imported. Approximately 300 different pesticides in more than 1000 strengths/formulations are distributed by more than 2000 sales agencies.

The quality control of pesticide is implemented by the government agency and the industry. This begins with the analysis of imported materials taken at the customs level. The quality control of locally formulated/manufactured pesticides is undertaken by the industry. Periodical monitoring of these pesticides and in the market materials are carried out by the government inspectors.

The government organizations within the Department ofAgriculture involved in the quality control of pesticides: The Division of Agricultural Regulatory looks after the regulation whereas the analysis of pesticides is conducted by the Division of Agricultural Toxic. Substance.

Methyl parathion, malathion, dimethoate, monocrotophos, carbaryl, sulfur, copper oxychloride, zineb, mancozeb, propineb, 2,4-D, dalapon, paraquat, atrazine and diuron are the most commonly used pesticides in the country. The analysis of these pesticides is done by a chemist/pharmacist. The Division possesses a range of analytical equipment, e.g., TLC, GLC, and HPLC. The analytical methods employed are those of CIPAC, AOAC, EPA and those of manufacturers' origin. No national specifications of agricultural pesticides are as yet available. However, as and where appropriate, reference is made to FAO specifications.

Additional resources, qualified personnel such as analytical chemists and training in the areas of operation and maintenance of specialized analytical instruments are seen to be the prime areas of improvement needed.

Suggestions have been given on the intra-regional technical collaboration on the quality control of pesticides as well as the atandardization of the performance of regional laboratories through interlaboratory collaborative studies on the analysis of pesticide formulations.

for manufacture of technical material and eleven (11) units for formulations. Facilities available at Agri and Namio good including many gas chromatographs having various detectors, liquid chromatographs and spectrophotometer. Operated by qualified persons. The self inspection system of products by qualified self-inspectors of the manufacturing organizations and subsequent rechecking by Namio seems efficient methods of quality assurance. There are stringent legal sanctions against manufacture of sub-standard products. Specifications for quality control stipulated by Namio mostly based on manufacturers specifications. It is also obligatory for every formulation unit to have experimental field for field tests of all formulations.

THAILAND

The poisonous active control Board constituted by officials from Ministry of Agriculture, Ministry of Trade and Ministry of Public Health is the regulatory agency for pesticides in Thailand. The Agricultural Toxic Substance as Division of the Department of Agriculture does the quality control and residue analysis of pesticides. Pesticides requirement met by imports of finished products and formulations of imported active materials. Formulation carried out by private industry. Analytical facilities available at Agricultural Toxic Substance Division included many GC, HPLC, spectrophotometers and other analytical instruments. However, quality control system needs improvement although private fromulations generally market good quality products. Quality checking and assurance by Gov't Agency not comparable to earlier two countries. Specifications followed by Agricultural Toxic Substances Division are those of international agencies like FAO, WHO, AOAC and EPA. Physical formulation characteristics generally not tested. Emphasis given to residue analysis. Visited a few formulation units also. Production pracesses are sophisticated, although quality mainly dependent on quality of the technical material imported. The Agricultural Toxic Substances Division also undertake extension services to farmers in the field of choice and proper usage of pesticide.

PAKISTAN

Visited pesticides Research Laboratory of the Pakistan Agricultural Research Council at Karachi and a few formulation manufacturing units. In Pakistan the pesticides committee headed by the Secretary, Department of Agriculture and Food is the regulatory agency for pesticides. Chemical and residue analysis are carried out by Federal Pesticides Research Laboratory at Karachi. Analytical facilities include two GC, HPLC, UV and IR spectrophotometers. Run by qualified persons. Being the only laboratory in Pakistan for quality control of pesticides the facilities need strengthening both in terms of equipments and personnel. Extension work is the responsibility of provincial Government and it is their responsibility to get the products tested in the Federal Pesticides Research Laboratory at Karachi. There are about 30 private formulation companies in Pakistan some of these are only dealers for imported materials. The quality control facilities in the few formulation units visited not very satisfactory, they depend mainly for analysis on the pesticides analysis laboratory of the Federal Government.

INDIA:

The quality control of pesticides in India, in brief, is as follows:

The Manufacture, import, sale and distribution of pesticides in India are regulated by the provisions of the Insecticides Act 1968 and Insecticides Rules 1971. All pesticides are required to be registered under provisions of the Act and Rules. The Central Insecticides Laboratory under the Ministry of Agriculture functions as the statutory laboratory to verify the claims made by the manufacturer or formulator at the time of registration. The Central Insecticide Laboratory has four divisions namely: i) Bioassay; ii) Toxicology and Pharmacology; iii) Pesticide residues and quality control and iv) Packaging and Processing.

The quality control and residue section is equipped with instruments like GC with integrator, IR and UV spectrophotometers, polarograph and TLC sets. It is manned by qualified chemists.

The enforcement of the provisions of the Insecticide Act after registration lies with the State Governments and Union Territories, who have appointed Pesticide Analyst and Pesticide Inspector for the purpose. There are at present 31 Pesticide Testing Laboratories in 16 state and one Union Territory. The central insecticide laboratory functions as an appellate laboratory in case of dispute on the result of analysis by the State Laboratories. 5 Regional Pesticide Testing Laboratories are being set-up under the Central Insecticide Laboratory.

There is also the Indian Standard Institute certification mark schem in India, under which manufacturers are licensed to use the ISI mark is obligatory. ISI has a Central Laboratory at Delhi and 3 Regional Laboratories.

The manufacturers of technical materials of pesticides and also most of the formulation units have well equipped quality control laboratories attached to their manufacturing plants.

Besides the above, other laboratories having facilities for quality control of pesticides are the PDPI laboratory, which was established with UN Aid, and laboratories of the Agricultural Universities and National Laboratories under the Council of Scientific and Industrial Research.

INDONESIA

The pesticide requirement of Indonesia are met mostly by local formulation of imported technical materials. Some of the formulations are also imported, specially for public health purposes. Major crop is rice. Indonesia started using pesticide as an agricultural input only since last 15 years. Government is encouraging the increased use of pesticides in agri culture by subsidising the pesticides required for agricultural programmes through schemes like BIMAS AND INMAS.

The manufacture of pesticide formulation is done by private industry Government is presently establishing a Technical Pesticides manufacturing facility for the manufacture of 4 pesticides namely, Diazinon, Phenthoate, Fenthion and BPMC, in one complex. The existing formulation capacity is much in excess of requirement. It is estimated that existing formulation capacity is adequate to meet the pesticide formulation production requirement for the next 5-10 years. There are about 17 formulation units mostly based on imported plant and machinery. The pesticide Committee of the Department of Agriculture is the regulatory agency for pesticides in Indonesia. The Institute for Research and development of chemical Industry in Jakarta, under the Ministry of Industry has facilities for quality control This laboratory has recently procured analytical equipment like GC, IR, UV and HPLC. However, these are not fully being utilized, because of the non availability of well trained personnel for the purpose. There are plans to depute a few persons for training abroad in this area.

Manufatures of pesticide formulations have quality control laboratories with the required analytical facilities and personnel. Generally Indonesia relies for the quality of pesticides on the manufacturers.

AFGHANISTAN

1. Major crops are rice, wheat, maize, cotton and fruits. Use of pesticide is quite limited, perhaps, owing to inconsistent attack of pests. Wheat, cotton and fruit trees sometimes become the target of pest. Pesticides are also used in domestic pest control, public health and for veterinary purposes.

2. Afghan Fertilizer and Agricultural Services Company, a Government Enterprise is solely responsible for importing,storage, distribution and sale of pesticides in this country. It has one Central Ware-house in Kabul, 28 depots in the 28 Provinces and about 550 licensed retailers. Price of pesticides is fixed by the Government, and it is no "no loss no profit" basis. Farmers can buy pesticides both from the depots and the retailers. Pesticides are also available for purchase from the street dealers who have no license. Quality is too uncertain there (Street dealers).

3. A few of the pesticides like methyl parathion 50 EC, Trichlorofor 80 WP and BHC dust which were found in central warehouse seemed to have undergone deteriorati n. No quality control facility is available in the country. All concerned with procurement and distribution and sale of pesticides feel that quality control facilities should be developed without any delay. One pesticide laboratory is being set up with the assistance of UNDP/FAO. It may need more than one year yet to start any analytical work there.

4. No specification is followed for procurement of pesticides and no preshipment inspection is got done. Some FAO specification as needed by them have recently been supplied to them by FAO. Rome at the request of the Consultant (Amin). A final report on "Quality Control of Pesticides and other related matters in Afghanistan" has been submitted to UNIDO,

Vienna for approval and then consideration for the Government of Afghanistan. The report deals in details on the matter.

5. Azinphos methyl, malathion, oxydemiton methyl, BHC, propoxur, parathion methyl, fenitrothion, trichlorfon, copper oxychloride, sulphuf, phenyl-murcury acetatec, 2,4-D sodium salt, aluminum phosphide (tablets) and zinc phosphide are considered to be important pesticides. Farmers prefer methyl parathion as they find it to be very efficacious.

SRI LANKA

1. The major crops using pesticides are rea, rubber and paddy. Copper and sulphur play important part. Other important pesticides are diuron, simazine, paraquat, parathion and propanil.

2. Malathion and fenitrothion are used only in mosquito control. Free import of pesticides is permitted which meet international specifications. An act to control pesticides has been passed but not being implemented now. Pesticide laboratory has very limited facility for quality control. The laboratory suffers very much from resignation and transfers of trained staff. Standard methods for quality control are needed

RECOMMENDATIONS:

1. Specifications for quality control should be fixed and be made uniform in the regional countries wherever possible. International specifications like FAO, WHO can be follwed wherever possible.

2. It should be made obligatory for all manufacturing units to have well equipped and well manned quality control laboratories. The self inspection system being followed in Korea can be considered for adoption.

3. Controlling agencies of the Government should have facilities form periodic and random checking of samples and enforcing legal sanctions on inferior product manufacturers. Regional laboratories under a central controlling laboratory can efficiently function.

4. Training programmes on quality control may be oragnized for the benefit of formulation manufacturers. There is need for training in modern methods of quality control.

SOME INFORMATION CONCERNING CIPAC

by

J. HENRIET
CIPAC Chairman
Station de Phytopharmacie de l'Etat
GEMBLOUX (BELGIUM)

1. Aims of CIPAC

The sigla CIPAC means "Collaborative International Pesticides Analytical Council Limited". It is an international non-governmental organization whose aims are:

a) to promote international agreement on:
   - methods for the analysis of pesticide products and of such other substances as the council may, from time to time determine;
   - methods for the physico-chemical evaluation of technical pesticide materials and formulations;
   - methods for correlating biological efficacy with physical and chemical properties of pesticide products.

b) to foster inter-laboratory collaborative analysis among interested laboratories.

c) to sponsor symposia to encourage the development of, and to promote discussion on, new or better methods of analysis and physico-chemical evaluation of pesticide products.

d) to publish from time to time:
   - agreed methods;
   - reports on the work carried out on such agreed methods;
   - proceedings of symposia;
   - any other appropriate material.

e) to collaborate with other organizations and persons concerned.

2. Members

CIPAC groups three kinds of members:

- the full members who are official analytical chemist personally apponted on the basis of their competence in the pesticide analysis,

of their contribution to collaborative studies and of their agreement to promote the CIPAC aims. Only onf full member is appointed per country.

- the correspondents who are representatives of official international organizations (AOAC, EED, FAO, ISO, WHO) or official national scientists who have contributed to CIPAC collaborative works.

- the observers who are scientists from official national laboratories invited to attend the annual meeting and to join CIPAC in its collaborative studies.

Moreover, CIPAC has established a close liaison with industry through GIFAP (International Group of National Associations of Manufacturers of Agrochemical Products), and invites scientists from industry to attend the annual meeting as Expert Witnesses for reporting and discussing on the analytical problems on pesticides from their own industry.

3. Organization of the Work

The main aim of CIPAC consists in the standardization of analytical methods and physico-chemical tests for evaluating the qualities of pesticide formulations. Any problem related to the residues is outside the scope of its activity.

The organizati n of the work for the standardization of a method can be summarized as follows:

a) Allocation of the leadership

The responsibility to study the methods and to carry out the collaborative trials is generally allocated to the member from the country where the pesticide is synthetized and is, or has been patented for the first time.

In countries with important pesticide production, the CIPAC member organizes a national committee grouping official and industry scientists in view to be helped in his work. He creates also sub-committees, panels or groups, the the chairmanship of which can be given to official or indstry scientists.

b) Survey of methods

Several analytical techniques can be used for determining the a.i. content. Therefore, before undertaking the preliminary trials, it is useful to gather information on the methods used in different laboratories generally by means of a letter-questionnaire.

c) Selection of methods

Depending on the replies, the leader can select one or several methods and investigates them in order to define the advantages and disadvantages of each of them.

d) Confirmatory trials

After having completed this investigation, the leader can decide on the method to be proposed to a collaborative study at an international level. However, before carrying out this collaborative study, it is recommended that the selected method be tested by two or three other laboratories in order to ascertain that the description of the method does not allow different interpretations which could render the method not workable.

e) International collaborative study

When the confirmatory trial has proved that the method is suitable and workable, a collaborative study is carried out on an international level.

For solicitating the participation to this study, the CIPAC Secretary sends an information letter to every members, AOAC and GIFAP, specifying:

- the name of the pesticide to be studied;
- a short description of the proposed method;
- the kind and the number of samples to be analyzed;
- the name and address of the leader.

f) Report of the international collaborative study

As soon as the leader has received back the results, he writes a detailed report in which the repeatability and the reproductibility of the method are calculated according to standard statistical analysis methods, and he presents his report at the CIPAC annual meeting.

g) Standardization and publication of methods

When the report proves that the method is workable and suitable, it is adopted at the annual meeting with the status "full method."

When the report proves that the method is not entirely satisfactory, it is adopted with the status "provisional method." When several methods have been standardized, only one is declared as the referee method and is to be used in case of dispute.

h) Publication of methods

The full and provisional methods are publised from time to time in CIPAC Handbooks and Proceedings.

4. Organization of the annual meeting

CIPAC organizes an annual meeting called "technical meeting" in member countries in rotation.

The objectives of the meeting are:

- the study of the analytical methods and physico-chemical tests proposed for standardization;
- the review of the pesticide active ingredients for which methods of analysis are desirable;
- the review of the physical properties of the pesticide formulations for which physico-chemical tests are desirable;
- the supply of reference products;
- the allocation of the leadership for carrying out the collaborative studies;
- any other problems related to the CIPAC aims.

This technical meeting is open to members, correspondents and observers. However, recognizing the help from industry, a part of the meeting is open to their scientists who are invited as Experts Witnesses.

Moreover, since 1967, a one-day symposium is organized in which papers are presented to a larger audience, on the following subjects: analytical methods, physico-chemical tests, impurities in technical products, specifications and any other subject dealing with the chemistry of pesticides but excluding residues.

5. Availabitlity of the CIPAC methods

The CIPAC methods are available to organizations, institutions and individuals but on the condition that the CIPAC source is quoted. They are extensively used by FAO and WHO as bais of the clauses included in their specifications, by national organizations for pesticide registration purposes and by industry for their own specifications.

APPENDIX 6

SCOPE OF QUALITY CONTROL PRACTICES

	COUNTRY	PRE DISTRIBUTION STAGE				POST DISTRIBUTION STAGE
		IMPORTED		LOCALLY PRODUCED		
		TECH MAT.	FORMULATED	TECH MAT.	FORMULATED	
1.	Bangladesh	A	A	-	A	B
2.	India	E	-	B/E	B/E	B
3.	Korea	E	-	B/E	B/E	B
4.	Nepal	C	C	-	-	C
5.	Pakistan	B/E	B/E	E	B	B
6.	Philippines	B/E	B/E	E	B/E	B
7.	Thailand	B/E	B/E	-	B/E	B

A - Mandatory by enforcement agency

B - Monitoring by enforcement agency

C - Optional by enforcement agency

E - Self-inspection by manufacturers

APPENDIX 6A

Some Notes On Pesticide Quality Control

by

J. HENRIET
CIPAC Chairman
Station de Phytopharmacie de l' Etat
Ministry of Agriculture
GEMBLOUX (BELGIUM)

1. Introduction

A technical product of a pesticide active ingredient is rarely suitable to be used as such in the field. Therefore, it has to be formulated.

This definition means a set of processes consisting in presenting an active ingredient in such a form that it develops a maximum biological efficacy in a given pesticide application technique, but remaining in acceptable economical limits.

This definition involves to know:
- the chemical and physical properties of the a.i.
- the application techniques : e.g. dusting, spraying ...
- the biology and behavior of pests.
- the industrial engineering processes.
- the chemical and physical properties of the formulation adjuvants and their action on the biological efficacy.
- the toxicity, secondary effects and risks of pollution.
- the industrial economical laws for reducing the production cost.

Whatever the physical state of the technical material, the formular must be able to present it in different types of formulation by choosing the appropriate formulation adjuvants and industrial processes.

The formulation is an art and that explains why different commercial products based on the same active ingredient content behave differently in the field.

The aim of a quality control is therefore to check that the chemical and physical characteristics of a commercial product shall be appropriate for obtaining a good performance in the field and to protect the pesticide users against the poor quality products.

The quality control must be based on two aspects:
- the chemical one consisting in the checking of the active ingredient content and of the absence of harmful impurities.
- the physical one consisting in the checking of the conformity of the physico-chemical properties of the product with the application technique.

2. Chemical Quality Control

This control is based on the availability of chimical analytical methods.

A perfect method should fulfill the following requirements:
- accuracy : giving the true value.
- precision or repeatability : giving the true value with a very low degree of variability in replicate analysis by the same or different analyst in the same laboratory.
- reproductivity : giving the tru value with a very low degree of variability in analysis in different laboratories.
- specificity : giving only the active matter to be determined and excluding any related compounds or interferences.
- practicability : not involving too much sophiscated apparatus and reagents not easily available.
- economy : not too much time consuming and applicable in routine work.

Moreover, in some particular cases, such as determination of toxic impurities in technical material and in formulations, or of pesticide residues, two other requirements are to be added :
- detectability : for measuring extremely small concentrations.
- sensitivity : exhibiting a high degree of response for small changes in concentration.

Of course, a perfect method does not exist. In practice, the analyst has to define what requirements the method must fulfill depending on the particular analytical problem he has to solve, and on the availability of equipment and facilities (special apparatus, reagents, ...).

As you know, many different methods are available, based on different analytical techniques :
- gravimetry
- titrimetry
- spectrophotometry (UV, visible, IR)
- electrometry (alectrolysis, polarography)
- chromatography (column, thin layer, gas-liquid and performance liquid chromatography)
- mass spectrometry.

It is one of the basic objectives of this meeting to exchange information on these techniques and on the standardization of the analytical methods, and we shall discuss deeply this matter later on during the meeting .

3. Physico-chemical Quality Control

This quality control is very important, because the performance of pesticide treatment depends mainly on the physical characteristics of the formulations.

Let us consider the different types of formulations, giving for each of them the basic requirements to ensure a suitable pesticide treatment.

3.1 Dusting Powdews (DP)

Dusting is an application technique in which a powder is dispersed as a cloud of particles by means of an air atream which is deposited on the targec by gravity.

Properties :
- to flow easily, freely and regularly from the hopper into the air stream and to be wholly dispersed in order to ensure an uniform deposit on the target.
- to adhere on the target to be protected.
- to contain an appropriate particle size distribution. Too many fine particles mean a danger of drift, too many coarse particles mean a very poor covering ratio on the target.
- to be free of particles agglomerates.

3.2 Wettable (or water dispersible powders) (WP)

Wettable powders are applied by spraying a liquid in which they are dispersed as a suspension.

Properties :
- to be wetted easily and immediately
- to be dispersed easily in water forming a suitable suspension
- to be maintained in suspension for a sufficiently long time
-- to be free from stable foam
- to be free from coarse particles or non-dispersible agglomerates which could cause the blockage of spray nozzles.
- to wet the target and spread on it to ensure a good covering ratio.

3.3 Solutions

Three (3) types of solutions are available.

3.3.1 Soluble Concentrates (SC)

They are liquid, homogenous formulations to be applied as true solutions of the active ingrdient after dilution in water.

Properties :
- to be free from extraneous insoluble matters.
- to give clear solution after dilution in different hard waters.
- to be not subject to crystallization when stored in cold conditions.

3.3.2 Ultra-low Volume Liquids (ULV)

They are homogenous liquids ready for use through ULV equipment.

Properties :
- to be free from extraneous insoluble matters.
- to have a flash point as high as possible.
- to be sufficiently viscous.
- to be adequately volatile
- to be not subject to crystallization when stored in cold conditions.

3.3.3 Oil Miscible Liquids (OL)

They are liquid, homogenous formulations to be applied as a homogenous liquid after dilution in an organic liquid.

They must possess the same properties as those defined for ULV formulations but in addition they must remain clear after dilution in the recommended organic liquid.

3.4 Emulsifiable Concentrates (EC)

They are liquid, homogenous formulations to be applied as an emulsion after dilution in water.

Properties :

- to be free from extraneous insoluble matters.
- to be free from water
- to form a stable emulsion for a given period of time, when diluted in different hard waters and to reemulsify easily after a long standing.
- to be free of stable foam
- to have a flash point as high as possible
- to be not subject to crystallization when stored in cold conditions.

3.5 Suspensions (or flowable) concentrates (SC)

They are stable suspensions of active ingredients in a fluid intended for dilution with water before use.

Properties :
- to be homogeneous or to be easily homogenized with a minimum agitation of the container.
- to flow easily when poured out of the container.
- to be dispersed spontaneously in different hard waters and to be maintained in suspension for a sufficiently long time.
- to be free from stable foam.
- to be stable during storage, especially free from cystal growth, bleeding, claying, caking, gelling, thickening and skinning.

3.6 Granules

Three kinds of granules are available.

3.6.1. Water soluble granules (SG)

They are formulations consisting of granules to be applied as a true solution of the active ingredient after dissolving in water but which may contain insoluble inert ingredients.

Properties :

- to be easily and rapidly dissolved in water
- to form a clear solution, but in certain cases, a small amount of insoluble material is allowed (e.g. anticaking agents).
- to be free from coarse particles or undissolved agglomerates which could cause the blockage of spray nozzles.
- to be stable when stored, especially to be not subject to caking.

3.6.2. Water dispersible granules (WG)

They are formulations consisting of granules to be applied after disintegration and dispersion in water.

Properties :

- to be disintegrated and dispersed easily and rapidly in water.
- to form a suitable suspension which is stable for a sufficiently long time.
- to be free from coarse particles or non-dispersible agglomerates which could cause the blockage of spray nozzles
- to be free from stable foam.
- to wet the target and spread on it to ensure a good covering ratio.

3.6.3. Granules (GR)

They are free flowing solid products of a defined granule size range ready for use.

Properties :

- to flow easily, freely and regularly from the hopper.
- to possess a suitable granule size range which is defined by a lower and upper limit and by the ratio between these limits.
- to be free of dust, especially toxic dust.
- to be not friable nor abrasive
- to be not hygroscopic
- to allow a suitable desorption and diffusion of the active ingredient.

4. Comments

That lists the properties to be evaluated for the main pesticide

formulations. Theoretically all these properties should be included as clauses in a specification. But, of course, a clause must must always be based on an analytical method, and presently such analytical methods are not yet available for all the clauses. Researchers are carried out for filling the gap, but many CIPAC methods are already available and published in CIPAC Handbooks.

An important property is to be added to every formulations. It concerns the chemical and physico-chemical stability during storage. It is not always proved that a relationship exists between a heat stability test in the laboratory conditions and what really occurs in the storage practice. But it is useful to foresee such a heat stability test together with clauses on water content and alkalinity-acidity - pH and other chemical and physical properties.

In Table 1, I have summarized :

- the main physical properties .
- the aim of every property
- the formulations to which the property is applicable
- the availability of CIPAC methods
- the normal limits

Of course, I must point out that all this information is to be considered in respect of each particular pesticide and that modifications or alterations of methods, normal conditions and limits are to be brought depending on each particular case.

TABLE 1

AIM OF THE PHYSICAL PROPERTIES AND AVAILABILITY OF CIPAC METHODS

	Physical Property	Aim of Property	Applicable to formulations*	Availability of CIPAC Methods	Normal limits
1.	material soluble/insoluble in a solvent	to determine the purity or impurity of the product	TC, SL.	Soluble: MT.4,5,6,7,9 71, 76, 87, 90 Unsoluble: MT.8,10,11, 16, 27, 35	depending on the act. ingred.
2.	acidity-alkalinity-pH	to ascertain decomposition of the act. ingred., deterioration of physical properties, danger of corrosion.	TC, DP, WP, GR, EC, SL, UL, SC	MT. 31, 66, 75	depending on the act. ingred.
3.	Water content	id.	TC, DP, WP, GR EC, SL, UL	MT. 17, 30, 40	depending on the formulation
4.	dry sieve test	to limit particles of unwanted sized	DP, GR DP, GR	MT. 59 MT. 59	Max. 2% on 150 um 5% on 75 um
5.	flowability	to ascertain the free flowing nature of the product	DP, GR	MT. 44 revised (for DP) no method for GR	max.: 12
6.	dustability	to ascertain the ability of dust to be dispersed	DP	No CIPAC method, but WHO/EQP/4R2.	
7.	wet sieve test	to avoid the blockage of spray nozzles	WP, SC.	MT. 59.3.	Max.: 2% on 75 um
8.	suspensibility	to determine that a sufficient amount of a.i. is still in suspension to give a satisfactory, homogeneous and effective spraying.	WP, SC	MT. 15 (for WP)	min. 50% but mainly depending on the a. i.
9.	wettability	to ascertain the product is rapidly wetted when added to water	WP	MT. 53	max.: 1 min without swirling.

	Physical Property	Aim of Propoerty	Application to formulations*	Availability of CIPAC Methods	Normal limits
10	persistent foam	to avaoid exessive foam when filing the spray tack	WP, EC, SC	MT. 47.1 MT. 47.2 (For SC)	max.:25 ml after 1 min.
11.	flash point	to evaluate the danger of flammability	EC, SL, UL	MT. 12	depending on nat. or intern regulations
12.	viscosity	to evaluate the flow properties of liquid	UL, SC	MT. 22	depending on the formulations
13.	emulsion stability	to evaluate the stability of the emulsion on standing	EC	MT. 36, 20	Cream : max. 4ml after 2 hours free oil : nil
14.	re-emulsification	to evaluate the ability to be re-emulsified after standing	EC	MT. 36	Cream : max. 4 ml oil : max. 0.5 ml after 30 min.
15.	pour-tap bulk density	to provide information for packaging and application requirements	DP, WP, GR.	MT. 33	depending on the f formulations
16.	dispersability	to assure that the product is adequately dispersed throughout the spray tank	WP, SC	MT. 160 (for SC)	not yet fixed
17.	cold test	to evaluate the danger of crystallization or separation of ingredients in cold climate	EC, SL, UL, SC	MT. 39	separation less than 0.3 ml at 0°C for 7 days
18.	heat stability	to evaluate the influence of temperature and time on the chemical and physical stability	DP, WP, EC, UL SC, GR, SL	MT. 46	Normal conditions 54°C for 14 days

* Code of Formulations :

TC	:	Technical	SL	:	soluble concentrate
DP	:	dusting powder	UL	:	ULV formulations
WP	:	wettable (water-dispersable) powder	GR	:	granules
EC	:	emulsifiable concentrate	SC	:	suspension concentrate

SPECIFICATIONS

	Country	National Standard	FAO/WHO	Manufacturers	Others
1.	Bangladesh	Bangladesh Standard Inst. specification - F	M	B	India Standard Institute
2.	India	India Standard Institute specification - M	A	B	
3.	Korea	NAMIO specification - M	F	M	
4.	Nepal	-	F	-	ISI specification
5.	Pakistan	Pakistan Standard Inst. specifications only 28 so far	M	B	ISI BS US AID
6.	Philippines	-	F	M	
7.	Thailand	-	F	M	

Following countries contemplating adopting National Standards based on FAO/WHO specifications and using CIPAC/AOAC methodology: Philippines, Thailand.

M - Mainly

F - Few

A - Where National specifications are not available

B - Where no National/International specifications are available.

APPENDIX 8

QUALITY CONTROL LABORATORIES/FACILITIES AND EQUIPMENT

Country	Quality Control Organization	Laboratories of the Enforcement Agencies	Facilities Available	Laboratories of the Manufacturers	Facilities Available	Others	Remarks
1	2	3	4	5	6	7	8
Bangladesh	Plant Protection Wing of the Dept. of Agricultural Extenstion.	Pesticide Laboratory of the Dept. of Agricultural Extension	Facilities available for chemical and instrumental methods of analysis including 4 GC, 1 UV, 1 IR and 3 TLC sets (expected to receive 1 HPLC)	Quality control laboratories available in a few manufacturing units	3 sets TLC, 1 GC, 1 Spectrophotometer (in future 1 GC 1 HPL)		Quality control facilities at the manufacturers' end need strengthening.
India	Ministry of the Central Agriculture and for Dept. of Agriculture of the State Gov't.	Central Insecticide Laboratory under the Ministry of Agriculture and 31 Pesticide Testing Laboratories of the State Givt. (3 more State laboratories being set up for regional laboratories)	CIL is equipped with facilities for chemical and instrumental methods of quality control. Also Bioassay testing toxicology studies. Instruments for quality control include 2 GCS, 1 IR, 1 UV, 1 polarograph. Some State Pesticide testing labs well equiped while others need strengthening (1 HPLC available).	Quality Control Tech Manufacturers of pesticides and also formulators.	Facilities available for Physican and chemical testing of pesticides. Quality control labs of small scale formulators need strengthening.	ISI Lab and PDPI Laboratory equipped for quality control of pesticides. Instruments include HPLC.	Quality control facilities of small scale formulators need strengthening. Also facilities of some State pesticide testing laboratories need strengthening.

1	2	3	4	5	6	7	8
Korea	National Agricultural Material Inspection office (NAMIO) of the Ministry of Agriculture.	NAMIO Laboratory	Laboratory equipped for physical, chemical and biological inspection of pesticide instruments include 5 GC, 4 LC liquid chromotograph 2 UV, 1 IF spectro photo meters and other analytical instrument (HPLC).	By rule manufactures are required to have well equipped quality control labs including facilities for physico-chemical and biological testing.	Facilities available good including GC and HPLC.		
Nepal	Department of Agriculture	No separate quality control laboratory. Presently quality control being done in other Govt. labs like Royal Drug Research Laboratory Agricultural Dept. Laboratory Food Research Labs etc.	1 AAS, 1 GC 1 UV. TLC facilities for conventional materials of analysis.				Independent Pesticide Quality control Laboratory need to be established.
Pakistan	Pakistan Agricultural Research Council	Federal Pesticide Research Laboratory, Karachi and Provincial Laboratory at Punjab Province.	FPRL equipped with facilities for physico chemical testing of pesticide and residue analysis Instrument include 2 GC, 1 HPLC, 2 UV and 1 IR spectro photometer.	Manufacturers laboratories need strengthening in terms of of equipment and personnel. (One manufacturer has facilities).	IR		Plans to have 5 more regional laboratories have been finalized.

1	2	3	4	5	6	7	8
Philippines	Fertilizer and Pesticide Authority	Pesticide Analytical Laboratory of the Bureau of Plant Industry.	Analytical facilities include 1 HPLC and 5 GC, 1 UV, 1 IR, 1 TLC set	Most of the formulation plant have quality control laboratory	Facilities in these laboratories include analytical instruments like GC, HPLC and UV spectrometers		
Thailand	Pesticide Authority of the Department of Agriculture	Laboratory of the Agricultural Toxic Substances Division of the Dept. of Agriculture	Facilities include 2 GC 1 HPLC, 1 UV 1 IR, 1 Atomic Absorption Spectrophotometer and 10 TLC sets.	The manufacturers of pesticides formulation have quality control laboratories.	These labs are equipped with facilities for physico chemical analysis of pesticides		The formulations control laboratory of the Agriculture Toxic Substance Division need strengthening Analytical instruments through available need to be operational (HPLC). Qualified Analytical Chemists required.

FIFTEEN MOST COMMONLY USED PESTICIDES IN THE PARTICIPATING COUNTRIES

	PESTICIDE	FAO SPECS	CIPAC METHOD	NATIONAL SPECS
1.	Carbaryl	* (1973)	*	ISI (1975), PSI (Tech)
2.	Malathion	* (1979)	*	ISI (1978) BDSI, PSI(1968)
3.	Methyl Parathion	* (1971)	*	ISI (1980)
4.	Diazinon	* (1973)	*	ISI (1980) BDSI, PSI (1971)
5.	Monocrotophos	-	-	ISI (1976)
6.	Endosulfan	* (1973)	*	ISI (1978)
7.	Carbofuran	-	-	ISI (1980)
8.	Mancozeb	* (1973)	No suitable identification test	ISI (1978)
9.	Paraquat	* (1980)	*	ISI (1982)
10.	Aluminum Phosphide	-	-	ISI (1980)
11.	Oxydemeton Methyl	* (1980)	*	ISI (1976)
12.	Phosphamidon	-	-	ISI (1981 BDSI
13.	2,4-D	* (1984)	*	ISI (1982)
14.	BPMC	-	-	-
15.	Zinc Phosphide	-	*	ISI (1973)

---

* available

\- not available

TEN PESTICIDES RECOMMENDED FOR COLLABORATIVE STUDIES AND METHOD OF ANALYSIS FOLLOWED BY PARTICIPATING COUNTRIES

Pesticide	CIPAC	Bangladesh	Pakistan	Thailand	Nepal	India	Philippines	Korea
Carbaryl	IR, HPLC	IR, UV, Chemical	Chemical, GLC	EPA	AOAC	Titration, Colorimetry	GLC, UV HPLC	GLC
Malathion	GLC	TLC, GLC	Chemical, GLC	GLC	GLC	Colorimetry	GLC	GLC
Diazinon	GLC	TLC, GLC	Chemical GLC, IR	GLC	GLC	GLC, Column Chrom	GLC, HPLC	GLC
Monocrotophos	-	TLC, GLC	TLC, GLC	EPA	Titri-metry	Titrimetry	GLC, HPLC Titrimetry	GCL, TLC
Endosulfan	IR, GLC	GLC	IR, GLC	GLC	GLC	Titrimetry	GLC	GLC
Mancozeb	Identity test not suitable. Until an acceptable identity test is adopted, CIPAC Method MT 130 may be considered.							
Paraquat	Colori-metry	Colori-metry	Colori-metry	Colori-metry	Colori-metry	Colori metry	Colori-metry	Colory metry
Aluminum Phosphide	-	Chemical	Chemical	Chemical	Chemical	Chemical	-	Titrimetry
Phosphamidon	-	Chemical GLC	Potentia-metry, GLC	GLC	-	No info	GLC	GLC
Zinc Phosphide	Chemical	Chemical	Chemical	Chemical	Chemical	Chemical	-	-

APPENDIX 11

PROPOSED LEAD COUNTRIES AND COLLABORATING COUNTRIES FOR COLLABORATIVE TRIALS OF ANALYTICAL METHODS

	Pesticide	Lead Country	Collaborating Countries
1.	Carbaryl	India	Bangladesh, Pakistan
2.	Malathion	Bangladesh	India, Korea
3.	Diazinon	Korea	India, Philippines
4.	Monocrotophos	Thailand	India, Philippines
5.	Endosulfan	Philippines	Pakistan, India
6.	Mancozeb	CIPAC	India, Bangladesh
7.	Paraquat	Korea	Thailand, Philippines, Bangladesh
8.	Aluminium Phosphide	Pakistan	India, Bangladesh
9.	Phosphamidon	India	Philippines, Korea
10.	Zinc Phosphide	India	Pakistan

APPENDIX 12

PROPOSED WORKPLAN FOR THE SUB-NETWORK ON QUALITY CONTROL

1. Training

Country	Field of Training	Proposed Duration	Proposed Location
Bangladesh	Modern instrumental methods of analysis, e.g., HPLC	2 man-months	EPA (USA) Denmark
India	Advanced instrumental methods of analysis; analysis of imputities	1 man-month	EPA
Korea	Analysis of impurities	1 mm	EPA
Nepal	Pesticide analysis	3 mm	Where training facility is available
Pakistan	Analytical instrumentation;	2 mm	US or any 1 developed country
Philippines	Analysis of impurities Lab techniques(residency)	1 mm 2 mm	EPA India

2, Consultancy/Experts

India	Instrumentation and equipment maintenance	2-3 mm
Pakistan	Instrumentation	1 mm
Philippines	Formulation analysis	1 mm
Thailand	Formulation analysis	1 mm

3. Study Tours/Attendance at Specialized Meetings

Bangladesh	One participant to CIPAC/AOAC Meetings
India	---do---
Pakistan	---do---
Philippines	---do---
Thailand	Study tour to visit other Pesticide Analytical Laboratories in the region (2 man-months)

4. Group Activities (Workshops/Seminars)

Annual workshop of one-week's duration to review and discuss the the latest developments in quality control of pesticides with two participants representing each participating country and international organizations like FAO, WHO CIPAC, AOAC and GIFAP. Venue can be decided at the next TAC Meeting.